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# the OIL AND GAS JOURNAL

JUNE 15, 1959

EXPLORATION p. 153
STATISTICS p. 166

New quotas raise imports slightly ▸ 61

Texans organize to answer critics ▸ 66

New perforating method developed ▸ 68

Aramco a leader in gas conservation ▸ 84

Economics of two-stage cat cracking ▸ 108

Refinery jobs and wage rates ▸ 121

RUBBER BALLS

REDUCE MIXING IN PRODUCT PIPELINES

p.86

*GIVE THEM YOUR TOUGHEST DRILLING ASSIGNMENTS...*

# Mid-Continent Rotary Tables are *BUILT TO TAKE IT!*

**Mid-Continent Rotary Tables are engineered and designed to withstand high rotating speeds and heavy loads under the toughest drilling conditions. Manufactured by Mid-Continent Supply's subsidiary, Unit Rig & Equipment Co., these Mud-Proof rotary tables are constructed to provide maximum strength and rigidity with minimum weight. Only the finest parts go into the Mid-Continent table, assuring smooth, trouble-free operation.**

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the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
June 15, 1959

Real significance of pipeliners' victory in Arapahoe case:

Decision imposes court restraint against Government's suddenly changing operating rules agreed to under a consent decree.

Upshot is that shipper-owners of Arapahoe Pipe Line can continue to draw 7% dividends based on total valuation of the line. They had been doing this from 1941 to 1957.

Government attempt to change this method has been killed. The Justice Department wanted to base dividends only on the capital stock investment of owners, excluding capital additions financed by borrowing.

Majority opinion was a neat wrist slapping for the bureaucrats (For details, see p. 64).

▼ ▼ ▼

Refinery runs were notably high last week.

They averaged 8,280,000 bbl. daily, the third highest weekly average of the year.

The other two high weeks: One in January when demand was about 2.5 million barrels daily higher than now. The other in March when demand topped the current early June average by about 1.3 million barrels daily (p.169).

Gulf Coast crude prices still shift a bit.

Crown Central reduced prices for Pierce Junction crude in the upper Texas coast and for Iota field crude in South Louisiana by 7 cents a barrel.

Nearly 11,000 bbl. daily of crude is involved. New top for the areas is now $3.23 for 40°-gravity and above with a 3-cent differential downward.

Lafitte Oil Traders also cut its southern Louisiana price by 7 cents to meet similar reduction made by Gulf Oil several weeks ago. Lafitte buys nearly 9,000 bbl. daily in 30 fields.

Distillate prices also are falling.

Esso has cut 0.6 cent a gallon from distillate prices for all methods of delivery on East Coast. Its summer-fill discount of 0.5 cent a gallon is not affected.

Latest Esso cut puts barge delivered price in New York harbor for No. 2 at 9.4 cents a gallon, off 1.6 cents since

The Oil and Gas Journal is published weekly with an additional issue in January by The Petroleum Publishing Co., 211 S. Cheyenne, Tulsa 3, Okla. Second-Class postage paid at Tulsa, Okla. Copyright 1959 by The Petroleum Publishing Co. United States and foreign rates to the petroleum industry, 1 year $5, 2 years $8, 3 years $10.

March. Gulf Coast prices are off 1.625 cents a gallon from winter's quotations.

Oil imports will jump 30,000 bbl. daily in second half.

Carson has put mandatory allowable at 1,450,362 bbl. daily for July-December period.

The quotas themselves will be down slightly in all areas east of the Rockies and up sharply on the West Coast (p. 61).

▼ ▼ ▼

Rotary rigs working in U. S. last week showed another good gain for the highest total of year so far.

Survey shows 2,245 rigs busy, up 79 rigs from week before.

Current total—except for a 3-week peak last December—is the highest since the end of 1957. Latest count represents a gain of 464 rigs at work since early February this year when the total was 1,781 rigs.

The high count gives an indication of big gains ahead in well completions in late June and during July.

Alaska probably will see 11 rigs busy this year drilling for oil, according to state predictions in Juneau.

Drilling plans currently known:

Pan-Alaska Corp. will drill in the Koyukuk basin...Mountain States Drilling will have rig operating for Standard of California on the Kenai...General Petroleum and Great Basins are still moving gear from Bear Creek Unit to drill site in the Nushagak basin...Union and Ohio are rigging up for their Kenai test...Standard and Richfield are still drilling directionally at their Swanson River Unit No. 4.

An estimated 30 field parties, meanwhile, will be busy this summer. Areas of most interest: Yakataga-Katalla area, Copper River basin, and the Arctic Slope.

Other news on the drilling front:

...John Mecom is testing below 20,000 ft. in Plaquemines Parish well. It could become world's second deepest producer.

...Magnolia is carefully coring at its 1 Kathleen J. Moore in western Pecos County, Tex., following oil flows from the Wolfcamp below 10,890 ft. A producer would mean a deep drilling comeback in the Delaware basin (See p. 78).

...Skelly Oil has the best oil producer in the Nebraska portion of the Las Animas-Cambridge arch Pennsylvanian play. Its 1 Reiher in Hitchcock County was completed for 348 bbl. daily from three zones in Lansing-Kansas City.

...French have successful stepout to Hassi Messaoud in Algeria. OML 75 adds 5-mile bulge to northeast flank of the proven producing area (See Foreign News, p. 81).

▼ ▼ ▼

Revolutionary new perforating process is being introduced to the industry by Western Co.

New technique uses a directed stream of abrasive-containing fluid to cut holes through casing cement and pay formation.

It is fast and effective. Resulting perforations into the formation can be measured in feet rather than inches (p. 68).

Largest field in Canada may emerge from Swan Hills region.

Recent developments already mean proven reserves estimated at 308 million barrels—some estimates his 500 million.

Discoveries to the south, southeast, and northeast of the main field indicate a real giant in the making. No dry holes separate recent strikes from the older field area.

Largest fields at present in Canada are Pembina with reserves of up to a billion barrels and Redwater with ultimate reserves of 850 million barrels.

California's heavy-crude producers face a new threat—imported electricity.

Congress is studying a proposal to bring surplus electrical power from Bonneville Power Administration in Washington to California.

Oil industry sources claim such a move would displace an additional 5 to 12 million barrels of fuel oil annually.

Producers already are watching their fuel market being eroded by continuing flow of out-of-state natural gas into the rich California economy.

This is currently being aggravated by loss of markets due to smog-control laws and drop in military demand.

Excess producing capacity in U. S. is 30%, in Canada 50%, and in rest of the world 15%, according to Jersey Standard's Stewart P. Coleman.

Spare refining capacity is running 16 to 20% in the U. S. and Europe and 10 to 12% in the Caribbean.

▼ ▼ ▼

Internal coating of gas lines is picking up rapidly.

Booster is test showing flow gains of 5% as a result of coating.

Two major coating projects have been started within the past week by companies which recently adopted the practice.

An 80-mile, 12-to-14-in. crude line is being considered by Pan American International in Argentina.

Line would provide outlet for newly developed production at Comodoro Rivadavia.

A $25-million gas-pipeline project finally has been confirmed by Texas Electric Service Co., big Texas utility.

The project involves 360 miles of pipe from Old Ocean in

Brazoria County to Graham in North Texas. The 290-mile main trunk from Old Ocean to Fort Worth will be 22 or 24-in. and the 70-mile lateral to Graham 16-in.

TESCO has signed contracts with Pan American, Magnolia, and a dozen other gas producers in Old Ocean for 100,000 M.c.f. daily at first stepping up to 150,000 M.c.f. later. Price is reportedly 21.5 cents per M.c.f. escalating 2 cents every 4 years to a 29.5-cent top (See p. 67).

Other pipeline notes: Monterey Oil has entered gas-pipeline business to supply industries along Missisippi gas from south Louisiana fields...Houston group is trying to obtain gas franchise to serve Anchorage, Alaska...TGT is keeping mum on what it plans to do with 792 acres of valuable land on Houston Ship Channel on which it holds option until June 23... Lebanon and Iraq Petrolum have ended years of bickering over pipeline transit payments.

▼ ▼ ▼

Real culprits in air pollution are unburned components in motor fuels.

Olefins are getting the blame, says Hugh Field of Atlantic Refining. But the hydrocarbons which pass through the engine unburned, especially during deceleration, are the big contributors to air pollution from auto exhaust fumes.

This may mean that exhaust pollution is essentially a boiling-range problem in the motor fuel rather than a result of its chemical makeup. Researchers are working toward trimming the heavy ends to insure complete combustion as a means of alleviating the exhaust problem.

Lube-oil consumption may be headed even lower.

Its use per 100 gal. of fuel is now only half of what it was 10 years ago.

Factors behind this decline, according to George Weamer of California Research Corp. are:

...Crankcase capacity has dropped from average of 6.6 qt. to 4.8 qt. in the last 20 years.

...Oil-drain periods have been extended by the public beyond API recommendations.

...Engine design changes have reduced consumption.

...Improved oils have also played a big role.

And now the popularity of smaller cars may add another factor pushing consumption farther down.

▼ ▼ ▼

Signal Oil & Gas may buy into a foreign marketing firm.

The West Coast company won't comment. But reports from abroad say Signal is negotiating with Paz Oil Co. for a third interest.

Paz currently handles half of Israel's marketing since taking over Royal Dutch-Shell's outlets last year.

# Good Wells Make Good News

## A Monthly Report on Wells That Are Now Worth More

**June 15, 1959**

Acid treatments are often the most profitable way to improve the permeability and drainage area of a well. Here are four recent examples of effective acid treatments by Dowell.

- **Nolan County, North Central Texas** (Water Injection Well) This open-hole completion was between 6165 and 6359 feet in the Strawn Reef. The pay is a highly soluble lime with good porosity and low, but varied, permeability. Since permeability varies widely in a lateral direction, deep penetration seemed necessary for good results. The Dowell treatment: three 5000-gallon stages of inhibited acid, with rock salt as a temporary plugging agent and a new Fluid Loss Additive (F.L.A.*) for deep penetration. Water injection increased from 326 to 630 bwpd at same injection pressure.

- **San Juan County, Utah** (Old Oil Well) This well had been completed into four sections of the Paradox lime, from 5554 to 5650 feet. Production had declined to about 100 bopd. Dowell injected 28,500 gallons inhibited acid with demulsifiers, surfactants and Fluid Loss Additive (F. L. A.) at about 25 bpm. 492 ball sealers were used in four stages, and 300 pounds of a temporary plug were used in three stages. After clean-up, well made 38 boph.

- **Breathitt County, Kentucky** (Old Oil Well) This open-hole completion was in the fractured, vuggy Corniferous dolomite from 1985 to 2005 feet. Decline rates have been extremely rapid in this field. Formation samples analyzed by Dowell indicated that most production came from vugs and fractures. The oil-bearing formation had a permeability of less than one millidarcy. Dowell recommended Heatblast*. 1000 pounds of magnesium pellets were "fractured" into the pay in two stages. Each injection was followed by inhibited acid with demulsifying and surface tension reducing agents added. A total of 5000 gallons of acid was used. Before treatment, the well produced about 20 bopd. Three months after treatment, production was steady at 80 bopd, pumping.

- **Lea County, New Mexico** (Old Oil Well) Production had dropped in a year from 500 to six bopd. This well, into the Pennsylvanian below 9300 feet, had been treated with 500 gallons of Mud Acid upon completion. After a study of the problem, a two-phase treatment was made. A spearhead of 20 gallons of Freflo* in 2000 gallons lease oil was followed by 2000 gallons Dowell inhibited acid with a demulsifying agent added. Production was boosted from six to 300 bopd.

When you specify Dowell for acidizing, you get the benefit of more experience than you can get from any other service company. For full information, call any of the 165 Dowell service points. In Canada, call Dowell of Canada, Ltd.; in Venezuela, United Oilwell Service. Dowell, Tulsa 1, Oklahoma.

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# IN THE NEWS

**General Interest:**

Imports Increased Slightly for Second Half of '59 ..... 61
Favored-Nation Clauses Slated for Review ..... 64
New Texas Committee Answers Critics of Oil ..... 66
Louisiana Gathering Tax Voided by Court ..... 74
Oil's Safety Record Gets Better Every Year ..... 79

**Pipelining:**

Supreme Court Upholds Pipelines' Dividends Payments ..... 64
Texas Electric Service Plans Intrastate Gas Line ..... 67
TGT Expansion Will Boost Capacity 20% ..... 67
Monterey Organizes Gas-Pipeline Company ..... 71
Pipeline Briefs ..... 78

**Processing:**

Refiners Are Taking a Close Look at Gasoline Sensitivity ..... 72
Processing Briefs ..... 76

**Foreign News:**

New Strike Pushes Hassi Messaoud Northeast ..... 81
Iraq Petroleum Boosts Lebanon's Transit Fees ..... 81
French Approve Jersey Standard Algerian Venture ..... 82
Oil Shows May Mean Spain's First Discovery ..... 82
Gas Conservation Is Catching On in Saudi Arabia ..... 84
(Ninth in a series of special foreign reports)

**Drilling-Production:**

New Erosion Method of Perforating Is Introduced ..... 68
Low-Cost Research Used to Study Water Flooding ..... 80
Louisiana Well May Become Second Deepest Producer ..... 80

**Exploration:**

Imperial Closely Guarding Judy Creek Results ..... 70
More Town-Lot Drilling Planned in Los Angeles ..... 71
New Platform With Cable-Tool Rig Hits in Erie ..... 76
Magnolia Well May Spark Deep Play in Delaware Basin ..... 78
North Dakota Oil Men Look at Nesson Anticline ..... 153
What Surface Electric Records Can Tell You ..... 154
Northwest Kansas Boom Is On Again ..... 158
Sixth Strike Hits in South Texas' North Alazan Field ..... 160

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# TECHNOLOGY—OPERATION

## Pipelining

Spheroid Separates Batches in Products Pipeline ..... 86

*By M. L. Barrett, Jr.*

Expandable elastomer spheroids placed at properly spaced intervals into the interfacial mixture between incompatible products will minimize and control interfacial mixing. The technique is being developed on Shell's 14-in. 250-mile Wood River-Chicago products line.

Fighting Corrosion in the Desert ..... 124

*By F. M. Maasry*

Corrosion mitigation on the 30-31-in. Trans-Arabian pipeline is complicated and difficult because the pipe is exposed to very corrosive conditions. All buried sections of the line are given a standard asphalt coating. In rocky areas heavy asbestos-felt rock shield was used for supplementary protection.

## Drilling-Production

Analyzing Water-Flood Data With Data-Processing Equipment ..... 90

*By R. C. Earlougher*

Data-processing equipment can be used to save many man-hours in the analysis of water-flood performance. Here is a system for using in an IBM 604 calculating punch and a 407 tabulator to develop water-flood data. Similar results can be obtained on other types of equipment.

Multiple Completions Put Profit in Offshore Wells ..... 102

*By W. W. Poimboeuf, Jr., and W. W. Cleply*

Though unpopular a few years ago, the multiple completion is here to stay. Production of several zones from one well can mean the difference between financial success or failure. This is especially true where formations are thin or otherwise marginal.

## Refining-Processing

Horsepower Conservation Will Boost Profits 94

*By E. W. Fitch*

An all-out effort to utilize wasted power is being made by the Falfurrias, Tex., plant of La Gloria. Exhaust steam is being used in low-pressure turbines. And the pressure drop wasted in fluids flowing through pressure-reducing valves is being converted to a source of power in many instances.

Sulfide Scaling Under Hydrorefining Conditions—2 ..... 99

*By W. H. Sharp and E. W. Haycock*

Hydrogen sulfide partial pressure, temperature, and composition of steel are the main variables which affect corrosion rate. Graphical summaries of predicted long-term corrosion agree well with reformer data but are conservative for mildly corrosive hydrodesulfurizer conditions.

The Economics of Two-Stage Cat Cracking 108

*By C. A. Rehbein, W. A. Mitchell, R. A. Wilson, and W. V. Medlin*

A commercial two-stage catalytic cracking plant has been in operation at the Anacortes refinery of Shell Oil Co. for about 3 years. This article presents a brief description of the unit, commercial experience with several types of feed stocks, the results of engineering studies of certain features of the unit, and a summary of a detailed economic analysis of the process.

Process Costimating ..... 121

Refinery jobs and wage rates—Part 1.

## DEPARTMENTS

| | | | | | |
|---|---|---|---|---|---|
| Advertisers' Index | 175 | Equipment Men in the News | 143 | Personals | 162 |
| Calendar of Events | 53 | Exploration Highlights | 153 | Production Statistics | 168 |
| Classified Advertising | 171 | Foreign News | 81 | Refining Statistics | 169 |
| Costimating | 121 | Journally Speaking | 57 | Statistical Summary | 166 |
| Drilling Contractors | 149 | Markets | 170 | They Say | 47 |
| Drilling Statistics | 167 | New Equipment | 131 | Trade Literature | 138 |
| Editorial | 59 | On the Job . . . Pipelining | 124 | Watching Washington | 65 |

*Norris Suggests:*

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## Helpful Hints

- Rods in singles only should be tailed into the derrick for running and should be handled with special care, avoiding bending, and contact with ground, walk, or ramp.
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- After removal of protector, "dope" or lubricant should be applied to pin thread.
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- Use torque type wrenches if available. Never hammer the box in making-up.
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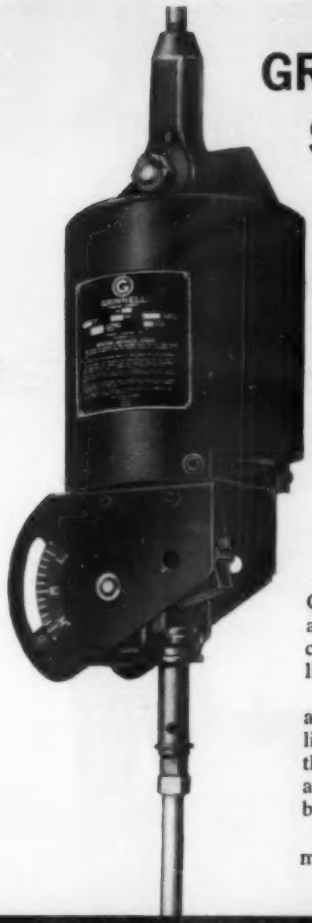

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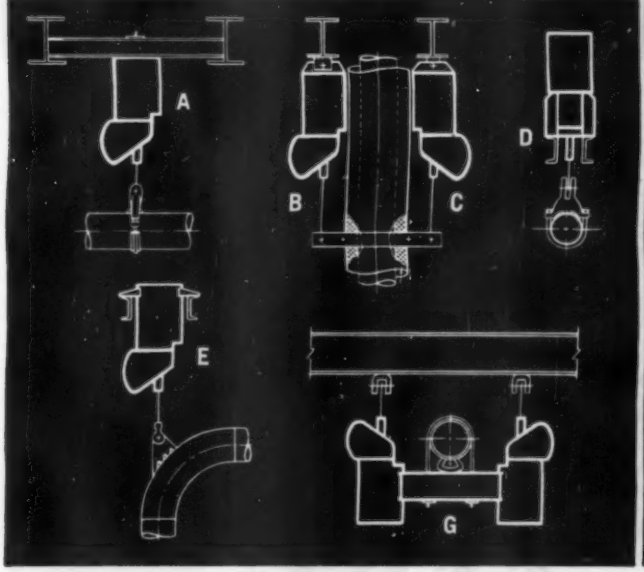


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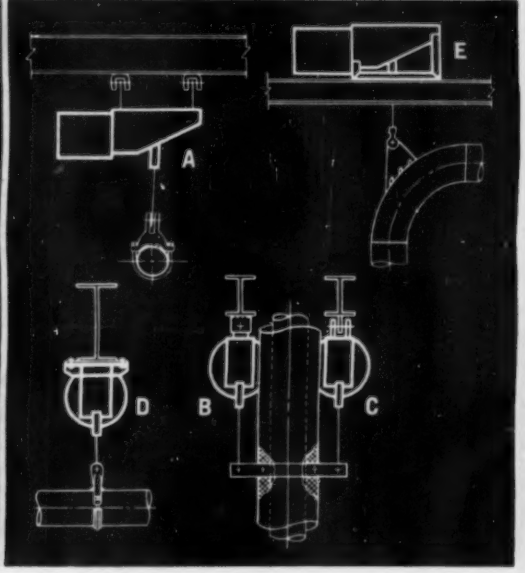


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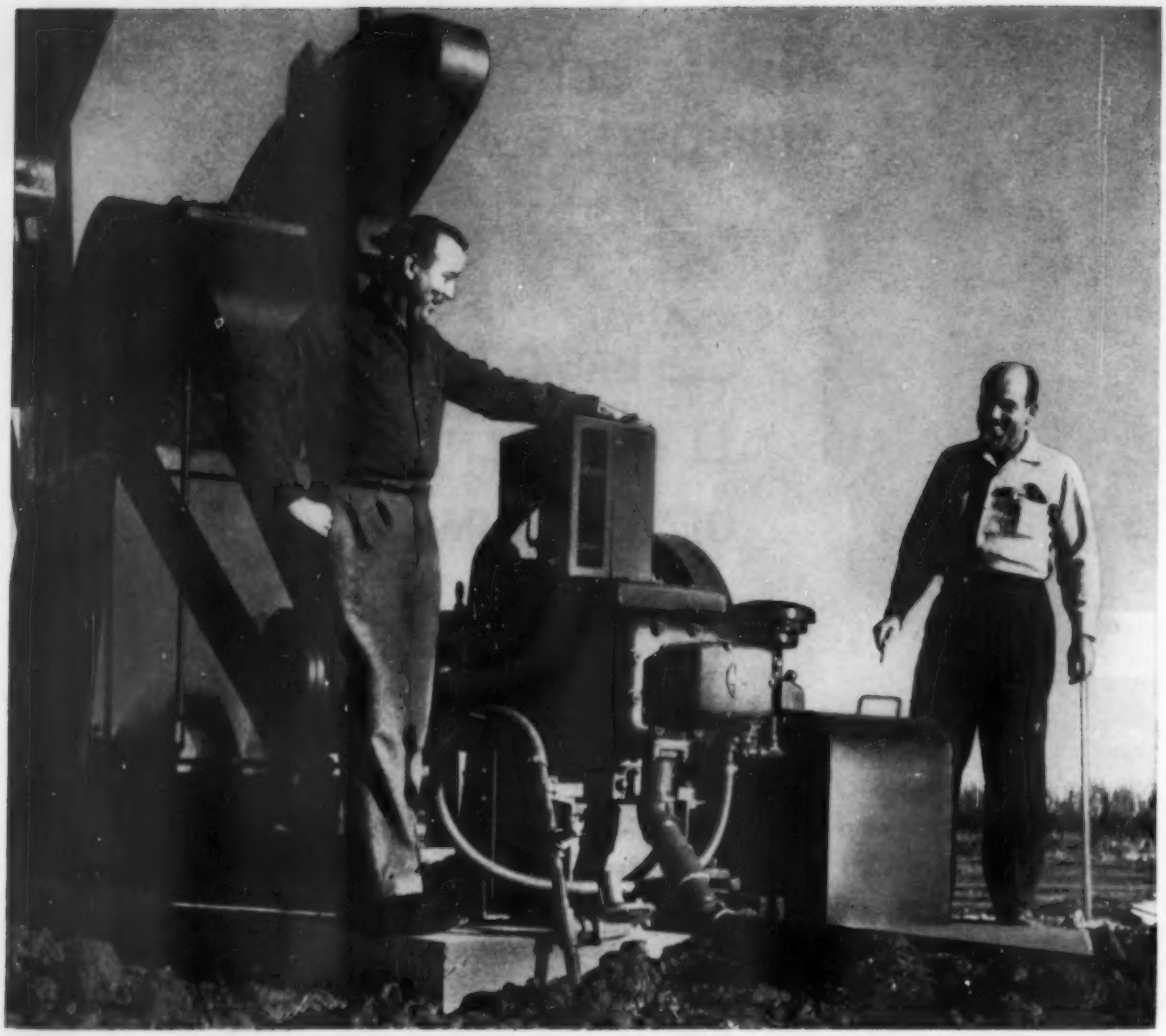

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says Sheldon Ward, Production Superintendent — John J. Eisner

**John J. Eisner** is a very active independent operator and producer in the West Central Texas area. His production superintendent, Sheldon Ward, has supervised the drilling and completion work on all the Eisner wells. Dependability and economy induced both Mr. Eisner and Mr. Ward to choose Witte as their power source for all their artificial lifting applications where single-cylinder engines were used.

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# Kellogg Sets New Standards of Reliability in Microwave

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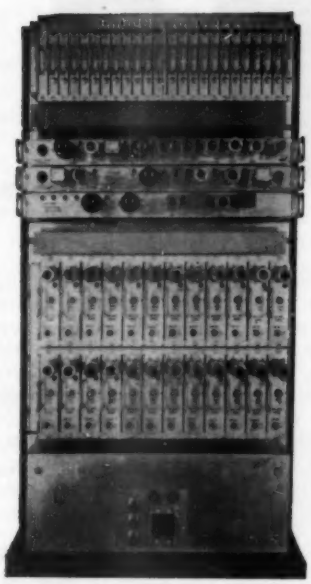
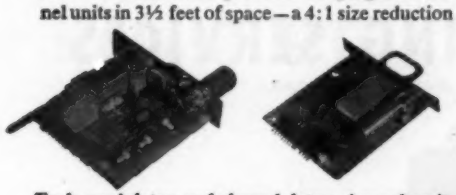


New MICROPLEX provides 23 plug-in channel units in 3½ feet of space—a 4:1 size reduction



Each modulator and demodulator channel unit features printed circuitry.

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- *Microwave* — operating in the 2,000 and 10,000 megacycles bands.
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Part of the Kellogg 10-C Microwave System is the new 10-C-2 "Microplex": a 23 or 45 channel PTM multiplexing equipment. It features printed circuits, miniaturized components, minimum maintenance, and occupies only three-and-one-half feet of rack space. All demodulators are semi-passive—only one tube per channel; modulators are passive—no tubes. The 23 channels use 41 tubes with an input of 180 watts —a 5:1 reduction in power consumption.

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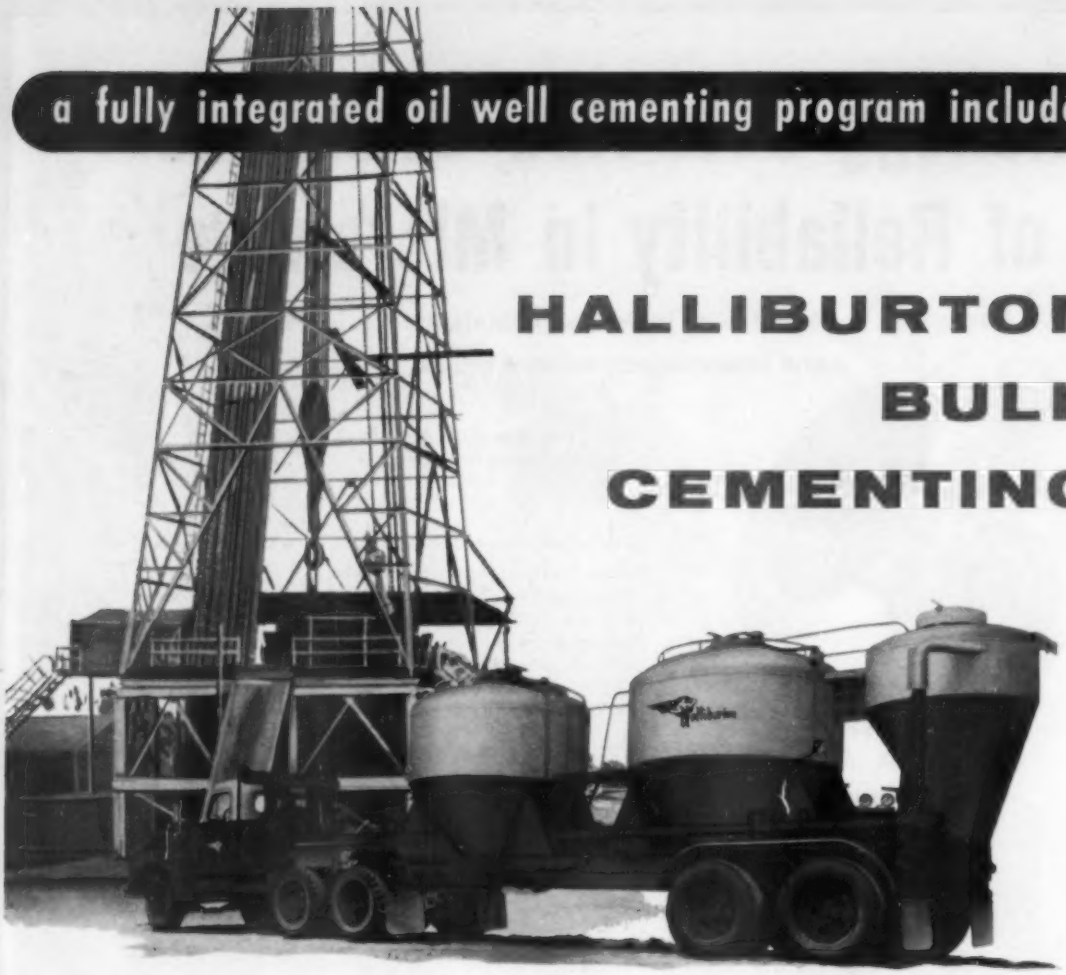
Communications Division of ITT

a fully integrated oil well cementing program includes...

# HALLIBURTON BULK CEMENTING



Bulk cementing, first introduced to the oil industry by Halliburton in 1940, represents another Halliburton development for better oil well cementing. The advantages and benefits of the original bulk cementing materials, equipment and techniques have been augmented through a continuous program of sustained improvement in bulk services... and have received enthusiastic approval of operators in all oil-producing areas.

Two types of Halliburton bulk handling materials plants serve the needs of the well operator. One type incorporates the mechanical screw conveyor system of handling and blending bulk materials; the other utilizes an even faster method--the pneumatic system.

Each Halliburton bulk materials handling plant is equipped to mix, by means of modern batch mixing machinery, any of the desired additives—for tailored slurries to meet specific well requirements—with the bulk cement. These mixtures, in carefully regulated proportions homogeneously blended, are loaded into Halliburton Rotovoys or Bulkhaulers for weather-protected delivery to your well.

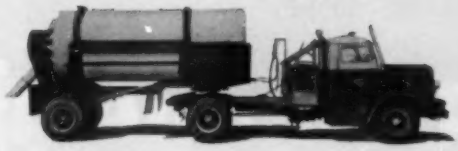
Bulk cementing offers you the greatest advantages... reduced cement waste... reduced handling costs... reduced industrial hazards... protected cement against weather while being hauled to well... No caking, lumping or spoiling of cement at well... Unused neat cement may be returned for credit. For your cementing requirements, be sure to call the pioneer and leader in bulk cementing...

## HALLIBURTON CEMENTING SERVICES

HALLIBURTON OIL WELL CEMENTING COMPANY • DUNCAN, OKLAHOMA

"CONTINUE TO LOOK TO HALLIBURTON—FOR LEADERSHIP"

# THESE HALLIBURTON CEMENTS AND ADDITIVES
# BOOST THE BENEFITS OF HALLIBURTON BULK CEMENTING



## POZMIX CEMENT...POZMIX 140

Pozzolanic cements help provide maximum oil well protection against corrosion, contamination, and ineffective bonding between pipe and formation. Pozmix Cement, a blend of Pozmix and portland cement, is designed for wells of moderate temperature; Pozmix 140, a blend of Pozmix with hydrated lime, is designed to obtain long pumpability and strength stability in wells where temperatures range from 140°F to 400°F+. Both Pozmix Cement and Pozmix 140 may be used with chemical additives, such as retarders, accelerators and low fluid loss agents, for better control during the cementing operation.

## GILSONITE CEMENT

Gilsonite is a recently-developed additive used to lighten cement slurry weight down to 10 lbs./gal. With its low specific gravity (1.07), it adds volume but not weight to the slurry. Setting characteristics are not appreciably affected; compressive strength is good. Because of its graded particle size, Gilsonite has very low fluid requirements: each 50 lbs. needs but 2 gallons of water. Even under normal pressure, Gilsonite will not take water from a slurry. Unsurpassed for lost circulation or weak formation problems.

## HA-5 ACCELERATOR

HA-5 is an improved accelerator for oil well cementing slurries to be used for surface pipe or shallow wells. Higher compressive strengths at early ages are obtained, sometimes permitting W.O.C. times as short as four hours on surface pipe temperatures of approximately 80°F.

## DIACEL D...DIACEL LWL

Diacel cement is a low density composition. Diacel D, a light weight additive blended with portland cement, is used to increase the volume of mixing water, resulting in a lighter weight slurry and a greater yield. Where low fluid loss properties are desired, Diacel LWL can be used to give filtration rates comparable to drilling muds. This low water loss additive can be used in virtually all types of cementing composition... also functions as a retarder for deep well cementing.

## HOWCOGEL

Howcogel is a high yield type bentonite used in cement to reduce slurry weight and increase slurry volume... reduces slurry cost. When mixed with drilling mud, Howcogel helps provide low fluid loss. It reduces filter cake thickness and has desirable gel-strength properties.

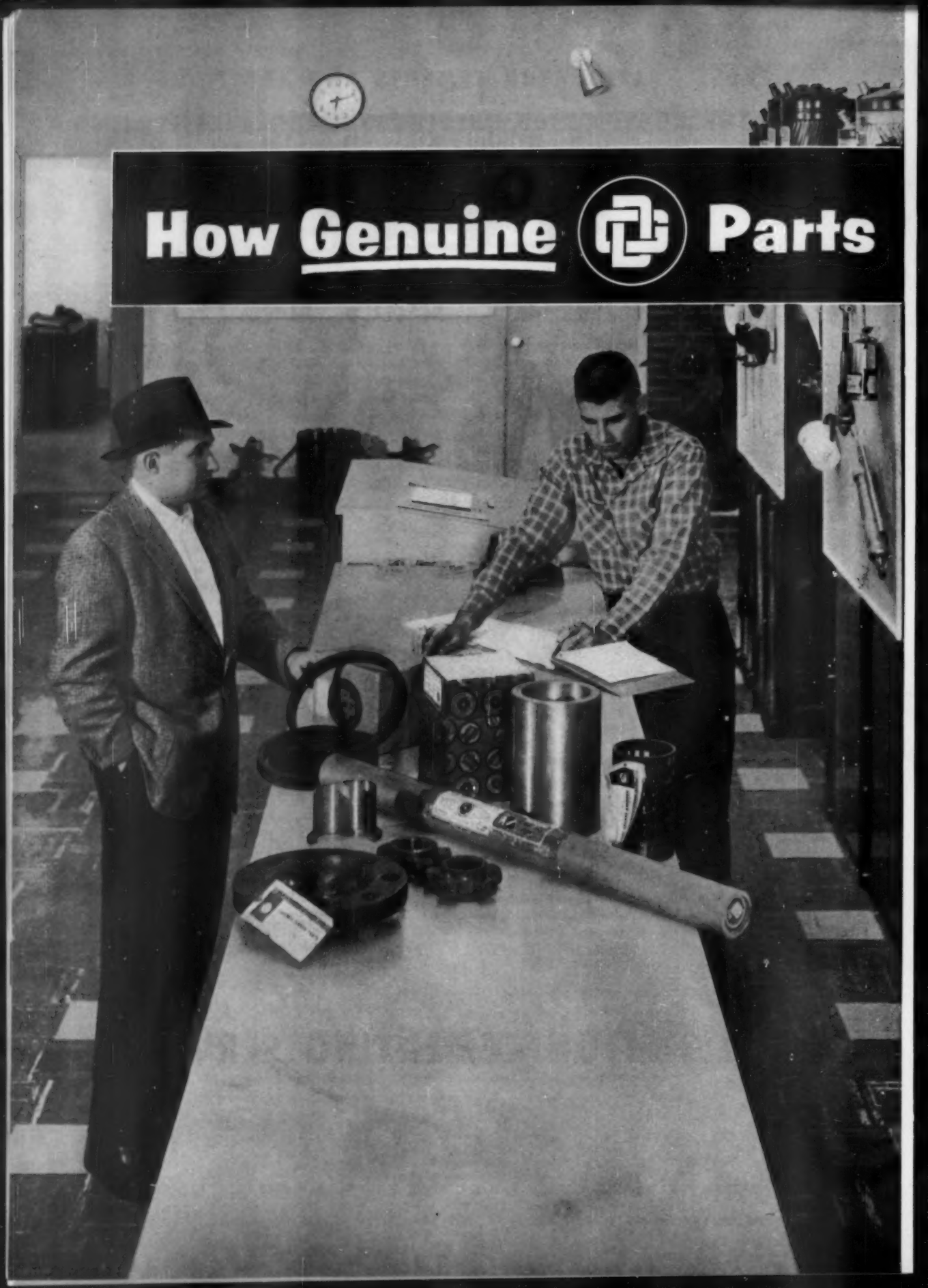
## CALCIUM CHLORIDE

An accelerator for Pozmix Cement or portland cement to increase the early strength and reduce the waiting on cement time. Calcium chloride is most effective at low temperatures (40°F - 100°F) for surface pipe or shallow wells.

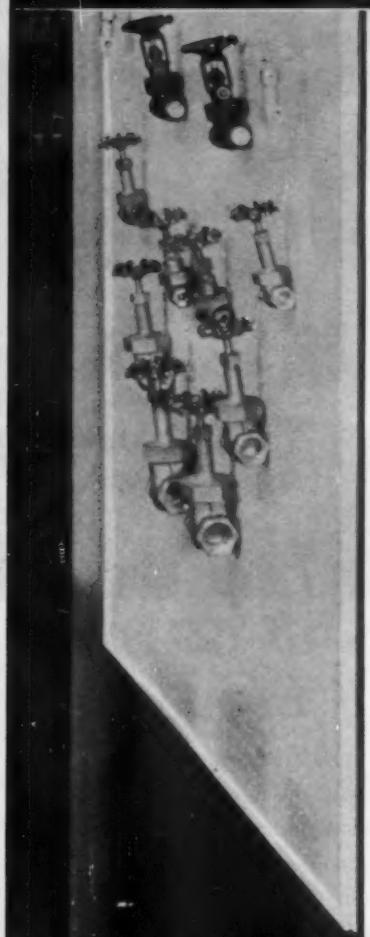
# HALLIBURTON CEMENTING SERVICES

HALLIBURTON OIL WELL CEMENTING COMPANY • DUNCAN, OKLAHOMA

"CONTINUE TO LOOK TO HALLIBURTON—FOR LEADERSHIP"


How Genuine Parts

# Extend Peak Performance



Only *genuine Gardner-Denver* replacement parts can:

- Keep your *G-D* mud pump operating at peak performance.
- Insure long trouble-free service.
- Prevent damage from mismatched parts.

When replacement parts are finally needed for your *G-D* mud pump it's smart to insist on *genuine Gardner-Denver* parts. Only *genuine Gardner-Denver* parts are made to the same high quality standards by the manufacturer who makes the pumps.

These parts will protect your investment in superior performance.

Genuine *Gardner-Denver* replacement parts are now available through all J&L Supply Stores. Your call is all we need.

**Jones & Laughlin**

**SUPPLY DIVISION** – Tulsa

If it's sold by J&L....
It's the best available

77

DRILLING EQUIPMENT: JONES & LAUGHLIN DRILL PIPE, CASING AND WIRE ROPE, GARDNER-DENVER MUD PUMPS, IDECO DRILLING RIGS, REPUBLIC ROTARY HOSE.

# FOUND IN THE FOUNDRY

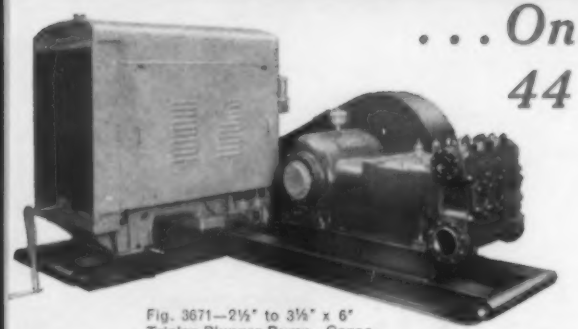


Fig. 3671—2½" to 3⅛" x 6" Triplex Plunger Pump. Capacities of 191 to 375 barrels per hour at working pressures from 1575 to 800 PSI.

## . . . One of the Secrets of GASO'S 44-Year Record of Leadership

No pump is stronger than the metal from which it is made, and no pump manufacturer casts his metal to more rigid specifications than Gaso. Here experienced foundry-men are preparing the mold for a Gaso power frame. Into it will be poured a special formula of molybdenum alloy cast iron. Test bars, sent regularly to a nationally known laboratory, consistently show a tensile strength of 45,000 to 48,000 lbs. per square inch. Another reason for the ruggedness of Gaso Pumps, their ability to withstand the shocks and strains of tough use, and their habit of outliving ordinary pumps . . . Latest catalog on request.

**DISTRIBUTORS:**

Farmington, N. M.—Gaso Pump & Burner Mfg. Co.
Shreveport, La.—W. L. Somner Co.
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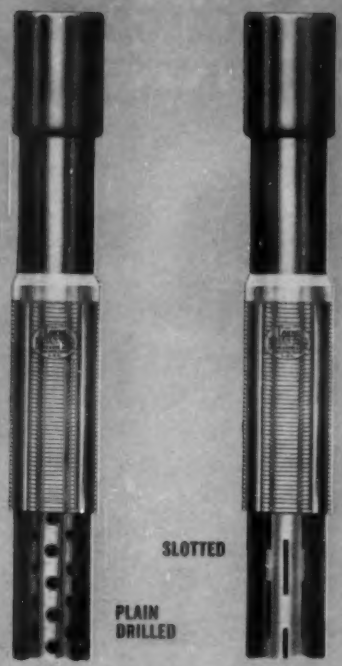
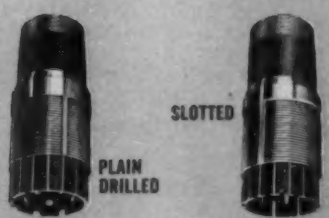
**GASO PUMPS**
*for every oil industry need*

**100th Anniversary of Oil in America** — 1959 — **44th Anniversary of Gaso Leadership**




All of the Layne Wire Wrapped Screen, except the "ribbed type," is wrapped directly on the pipe surface for strength and rigidity. The fluid flows laterally following the inverted V shaped channels between the wire wrapping for a natural cleaning action. Two types of pipe perforation, the plain drilled or slotted, are available. Both have excellent performance records and choice between them depends upon conditions encountered.

## RIBBED TYPE




The Layne "channel ribbed type" screen is identical to the "wrapped on pipe" type except that the wire wrapping is separated from the surface of the pipe by longitudinal bars which are secured by the tension applied through the wire wrappings. The fluid flows longitudinally (up and down the pipe) across the gauge openings of the elevated screen.

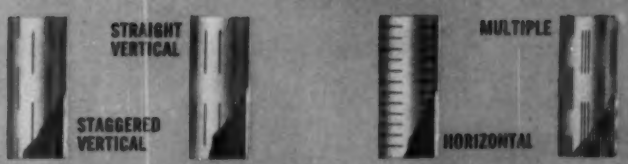
the answer to your sand problems

# LAYNE SCREENS

When sand is a problem, then there's one course of action . . . call Layne. Layne screens are precision engineered to your specific needs. Accuracy and uniformity of wire wrappings are guaranteed. Any gauge opening can be furnished from 4/1000 of an inch up on any size or kind of pipe. If the sand is too fine to screen, then the Layne Gravel Packing is the solution. The Layne Engineering Department will determine the exact gauge opening you need if sample of sand is submitted. For complete information on prices and specifications, write or call

THE LAYNE

**THE LAYNE & BOWLER COMPANY**
**P.O. Box 1327, Houston 1, Texas**
**ORchard 2-7561**

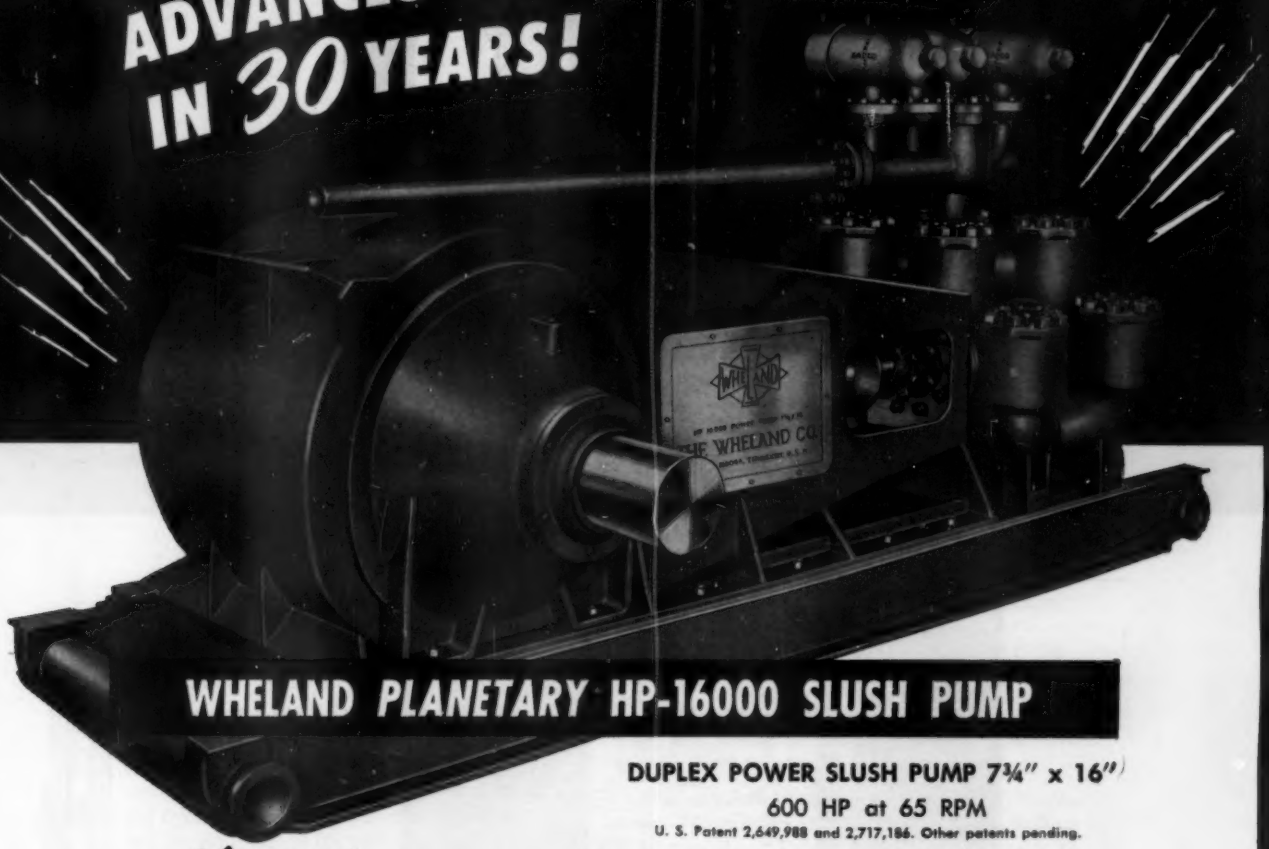



## SLOTTED PIPE

Layne Slotted Pipe is available in four types as shown above. Layne slotted pipe is precision cut with no excess of metal removed — just enough for the opening desired. Width of the openings are the same through the entire pipe wall. Pipe can be furnished in any length or size with standard threads and couplings, or with flush joint threads.

NOW! Direct connecting service from
Texas and Oklahoma via Western Airlines to
EDMONTON • CALGARY
and Casper, Wyoming
Braniff serves
both U.S.A. and
South American oil fields
...as no other airline does!
BRANIFF International AIRWAYS
General Offices: Dallas, Texas

# MOST IMPORTANT ADVANCES IN PUMP DESIGN IN 30 YEARS!




## WHELAND *PLANETARY* HP-16000 SLUSH PUMP

**DUPLEX POWER SLUSH PUMP 7¾" x 16"**

**600 HP at 65 RPM**

U. S. Patent 2,649,988 and 2,717,186. Other patents pending.

***NOW!*** **FOR THE FIRST TIME . . .**

**these proven mechanical principles are applied to a slush pump!**

- **PLANETARY GEAR SYSTEM**
  with gear cartridge assembled and inserted as a unit.
- **CROSSHEAD IS A PERFECT CIRCLE**
  thus stays perfectly aligned in every direction.
- **FLOATING INPUT SHAFT**
  with unique sheave mounting which lets shaft transmit torque load ONLY.

Three years in designing, developing and in final field testing are behind this newest, most advanced WHELAND 16" PUMP. A folder giving the highlights of this new pump is yours for the asking . . . or we can give you current locations so you can see it in operation. You can't afford to buy any pump in this size until you've seen this new Wheland pump!

# WHELAND

*ROTARY DRILLING MACHINERY*

**THE WHELAND COMPANY**

CHATTANOOGA, TENNESSEE, U.S.A.

**DRAW WORKS • SLUSH PUMPS • ROTARIES**
**CROWN BLOCKS • TRAVELING BLOCKS • SWIVELS**

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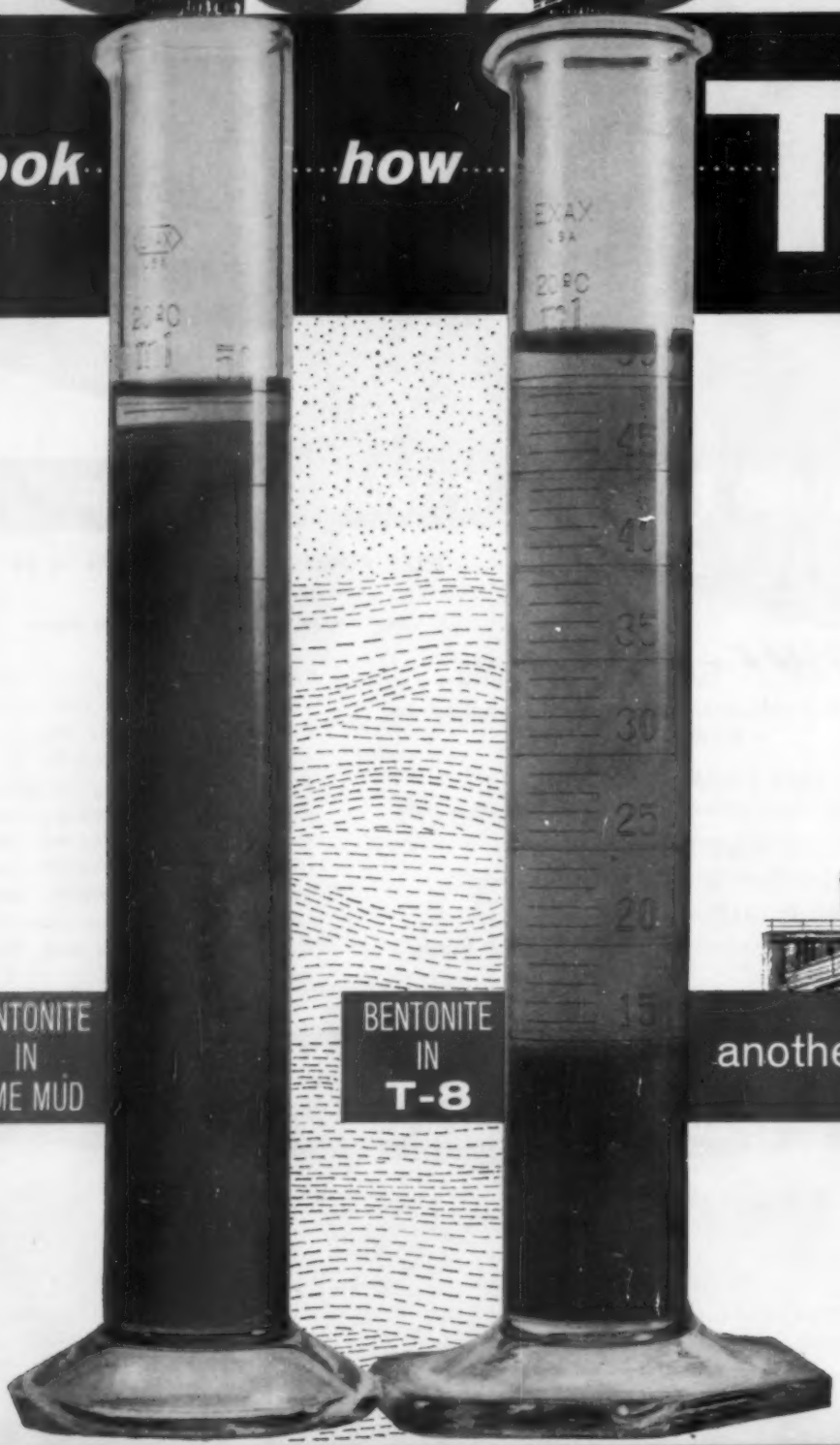
EXPORT DISTRIBUTORS: LUCEY EXPORT CORPORATION—233 Broadway, New York 7, New York—Broad Street House, London, E. C. 2, England.

well a well b

# Look how T-8



another *well done*

# ....and Magcobar engineering cut mud cost on well

NEW ORLEANS AREA

| | depth | type mud | weight mud | cost of mud |
|---|---|---|---|---|
| a | 13,600 ft. | Lime | 15.6 lb./gal. | $130,000 |
| b | 13,590 ft. | T-8 | 15.6 lb./gal. | $ 65,000 |

All along the Gulf Coast, savings have been substantial using T-8 instead of other muds in drilling shale formations. The secret of T-8, as the graduates to the left show, is that it reduces the hydration and dispersion of solids, minimizing the build-up of formation solids in the mud system.

With other muds, shale solids become part of the drilling fluid, increasing the viscosity. Water, added to reduce viscosity, lowers the mud weight, and new barite must be added. The additional barite and water increase the volume, so that expensive mud is jetted. With T-8 you can maintain good mud properties with less jetting, less barite, and at impressive savings.

The successful field performance of T-8 confirms Magcobar's basic approach to drilling fluid problems: Developing better products to solve specific drilling problems, and training better mud engineers to insure the highest level of performance from these products.

T-8 is only one of Magcobar's many answers to the problem of high drilling costs. The right products *used right* by Magcobar can cut costs on your next well, too.

*Wherever your drilling operations, you can use Magcobar engineering and products. There are more than 500 stockpoints in the U.S. and Canada. Elsewhere, write Foreign Operations, P. O. Box 6504, Houston, Texas.*

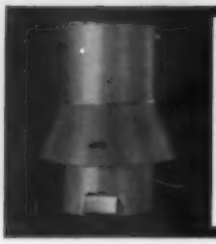
with Magcobar Technology

**MAGNET COVE BARIUM CORPORATION**

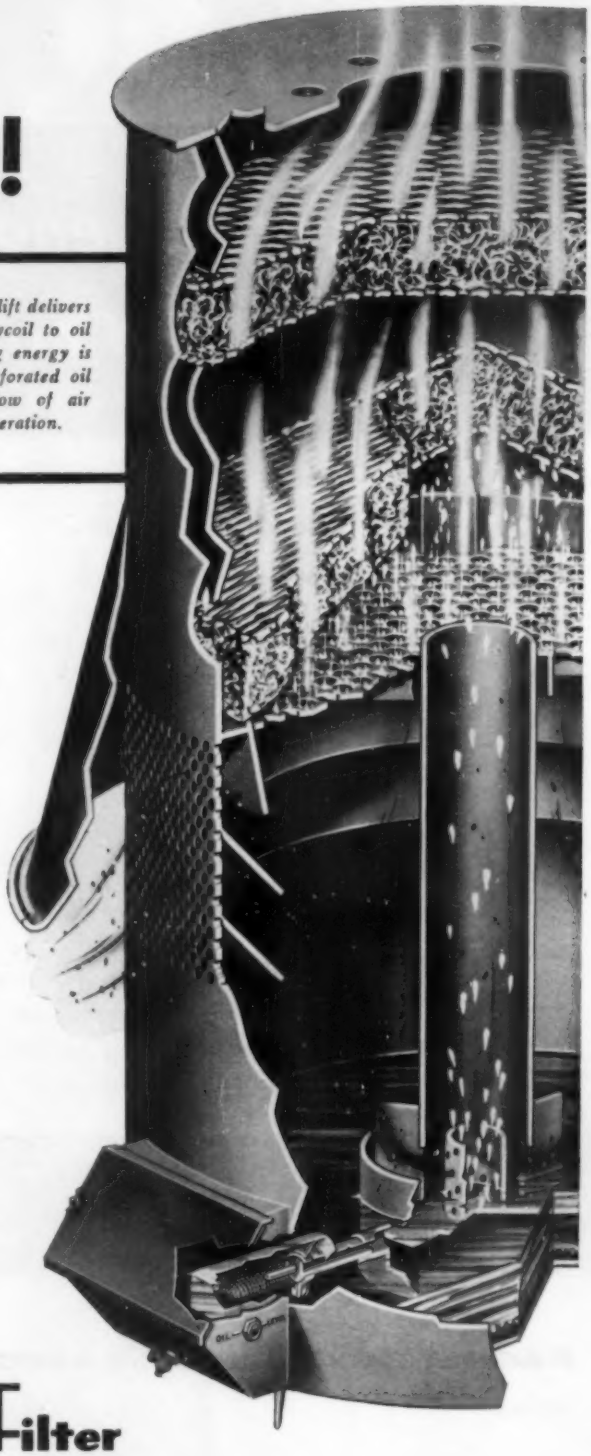
Houston

Magcobar
*Complete*
DRILLING MUD SERVICE

# NEW AAF Cycoil air cleaner has no moving parts!



**HERE'S HOW IT WORKS**—*Pneumatic oil lift delivers oil from reservoir at bottom of Cycoil to oil distribution plate. Source of lifting energy is the static pressure drop across perforated oil distribution plate, resulting in flow of air through plate when Cycoil is in operation.*



Now, an even more trouble-free engine and compressor air cleaner from AAF: the new Type P Cycoil!

Here's the *only* oil-bath air cleaner available which utilizes pneumatic lift, doing away with any need for oil pump and motor. And with pump and motor "designed out" there is nothing to lubricate, no brushes to replace, no circulator to wear out.

**Just read these other "plus" features of the new Cycoil:**

- **No wiring or on-site power needed; no problems of voltage rating, phase designation, or special protection for hazardous locations. No power bill to pay!**
- **Same low operating resistance and wide range of operation.**
- **Pneumatic oil lift a structural part of the inner Cycoil. No external piping or connections, with their possibility of oil leaks.**
- **Improved method of sludge removal.**
- **Shipped completely assembled. Just provide suitable supports and attach to air intake pipe!**
- ***Absolutely no sacrifice* in the quality of performance and construction which have characterized AAF's Cycoil line for 25 years.**

Interested? Get complete information from your nearest AAF representative, or write direct for Bulletin 160. Address: Mr. Robert Moore, American Air Filter Co., Inc., 444 Central Ave., Louisville, Ky.

AAF **American Air Filter**

BETTER AIR IS OUR BUSINESS

*How you can tell it's*

# BUILT LIKE A MACK

If the trim, functional lines don't tell you . . . if you don't spot the famous Mack bulldog perched up in front . . . you can tell in other ways.

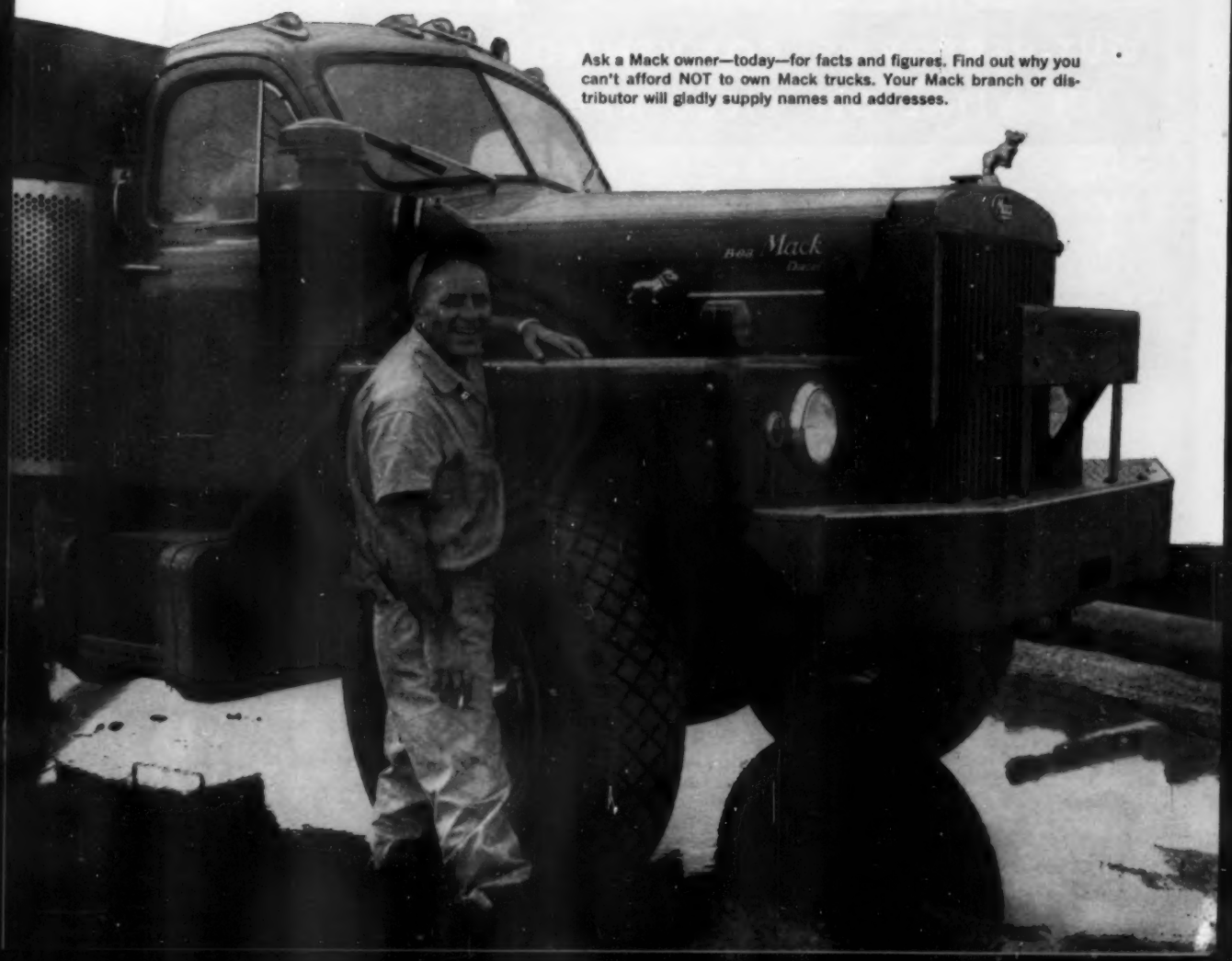
**Take the attitude of the man at the wheel.** He's proud to be driving the world's finest truck—the safest, sturdiest, best-handling job of its kind—and he doesn't mind letting you know it.

**Note the business-like looks.** No costly, useless passenger-car styling frills. And even older Mack trucks are a cinch to recognize—partly because of the sturdy construction that's a Mack trademark . . . partly because Mack users take extra pains to maintain their top earners in like-new condition.

**And consider the owner's name.** A Mack operator is likely to be a successful operator. He knows from experience about the ruggedness and mechanical superiority of Mack-built engines, transmissions, frames and axles. He knows these factors pay off big—in earning power, in economy, in dependability and in mileage life that can't be equaled.

**But the best way to know a Mack is to own a Mack!** Why not find out for yourself, soon, why there are so many Mack trucks *to* recognize—on the highways . . . in oil-field service . . . in logging, mining and construction . . . and wherever important work's in progress. Mack Trucks, Inc., Plainfield, New Jersey. In Canada: Mack Trucks of Canada, Ltd.

**MACK** *first name for* **TRUCKS**




Ask a Mack owner—today—for facts and figures. Find out why you can't afford NOT to own Mack trucks. Your Mack branch or distributor will gladly supply names and addresses.

# RIGID PLASTIC PIPE made of

# CYCOLAC®

THE TOUGH, HARD **ABS** PLASTIC
*from* BORG-WARNER

## OUT-PERFORMS CONVENTIONAL PIPE IN VITAL OIL FIELD APPLICATIONS!

Ideal for salt water well tubing, for salt water gathering and disposal lines • Safely carries sour crude • Serves as fresh water lines on leases • Handles water flooding jobs

No other pipe combines so many benefits in terms of installation, performance, long-term economy! That's because no other material is exactly like Cycolac — the new standard for quality in the plastics field. Pipe made of Cycolac has been thoroughly proved in use . . . in the oil fields.

*Write for the name of your nearest supplier*

### *10 Reasons why you're right with Rigid Pipe made of CYCOLAC!*

1. **LIGHTWEIGHT.** Easy to carry — approximately ⅛ the weight of comparable iron.
2. **RUSTPROOF, ROTPROOF.** Unharmed by soil acids — never corrodes or scales.
3. **CHEMICALLY RESISTANT.** Carries waste, salt solutions, organics with wet corrosives.
4. **HARD AND TOUGH — SUPERIOR TENSILE STRENGTH.** Excellent burst-resistance, even at high temperatures.
5. **LOW FRICTION LOSS.** Mirror-smooth interior surfaces insures higher rate of flow.
6. **VERSATILE.** Used for process piping — water systems — natural gas — electrical conduit.
7. **NON-TOXIC.** Approved for potable water by the National Sanitation Foundation.
8. **EASILY JOINED WITH METAL.** Used to replace corroded sections or to line metal pipe.
9. **EASY TO INSTALL.** Quickly jointed — less ditching — no costly handling equipment.
10. **LOW IN COST.** Less than most metal or plastic pipe — greater serviceability.

PACESETTER IN
**Marbon CHEMICAL**
SYNTHETIC RESINS

**Division of BORG-WARNER • Washington, W. Va.**

*also represented by:*
WEST COAST: Harwick Standard Chemical Co., Los Angeles, Cal.
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# NEW FROM CONTINENTAL-EMSCO

# NEW FROM CONTINENTAL-EMSCO





## TESTS EXCEED HARDEST FIELD USAG

Continental-Emsco Unit Pump are tested thoroughly and scientifically at varying loads up to maximum according to best engineering procedur with electric strain gauges at all stress points.
This gives a positive check on engineering design . . pr that design is correct and superior in performance.
Additionally, every gear reduc is load tested under its rated torque at the plant.

# NOW CONTINENTAL-EMSCO UNIT PUMPERS *give* GREATER EFFICIENCY *of* APPLICATION *and* COUNTERBALANCING *and* LOWER POWER COSTS

In the interest of reducing lifting costs, Continental-Emsco has redesigned its complete line of unit pumpers to conform with API suggested standards.

- **IMPROVED TORQUE FACTOR** . . cuts power costs
- **FLEXIBLE** . . meets all varied well requirements
- **RELIABLE** . . new designs, combined with proven C-E features, meet rigid standards through exhaustive, scientific tests

**TALLER SAMSON POSTS**— Greater height improves the geometric design of the unit and tends to equalize the loading between wrist pin and polished rod. This gives increased operating efficiency by decreasing torque at the wrist pins for longer bearing life . . *permits more exact balancing . . easier starting and less peak power demands* . . less fuel or electricity costs . . less wear on reduction gears. A 1.06 torque factor has been attained by this design for all units in the line.

**MORE FLEXIBILITY** — A choice of 18 different Continental-Emsco Unit Pumpers makes it possible to obtain the right torque capacity, structural load, and stroke length to pump all wells and to meet various installation practices and types of prime movers.

**IMPROVED GEAR REDUCER** — Newly designed oil troughs cast into the sides of the reducer box eliminate fabricated oil troughs . . provide superior lubrication to all bearings . . and make inspections more effective. Other dependable C-E features have been retained for long service life.

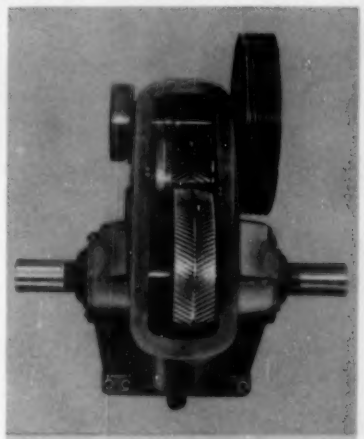
**NEW WRIST PIN DESIGN** — Faster and easier field assembly and changing stroke lengths have been achieved by Continental-Emsco new wrist pin bolt-on-type assembly design. Assembly is accomplished by running two bolts through the joint halves and tightening to bring the halves together . . accurately and simply. Pins are hydraulically removable.

**NEW BEARING ASSEMBLIES** — All bearings carry a manufacturer's B-10 rating for longer . . guaranteed life. They are offered completely pre-lubricated with special lubricants for the life of the bearings, eliminating need for continual maintenance, or in the normal set-up for re-lubricating as usual.

**STANDARD QD SHEAVES** — Another cost and time saving feature is the use of standard QD sheaves . . readily available at sheave dealers, everywhere . . lower in cost than special sheaves.

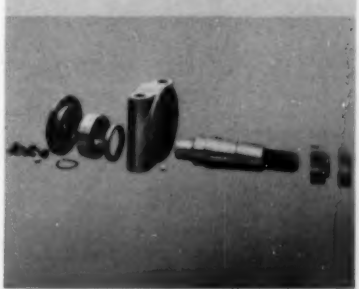
**ENGINEERED** *Even Better . .*

**NOT JUST BUILT**



New Gear Reducer with Built-in Oil Troughs

Typical Construction of Equalizer and Center Iron



Bolt-On-Type Wrist Pin Assembly

# NEW UNIT DESIGNATIONS FOR CONTINENTAL-EMSCO UNIT PUMPERS

The API proposal includes the adoption of standard method of naming unit pumpers, as follows: (1) First designation .. API gear reducer size; (2) Second designation .. figure indicating *structural* capacity in hundreds of pounds; and (3) Third designation .. maximum stroke length.

**Example: DB16-53-30B**

| | |
|---|---|
| DB* . . . . | Double Reduction Gear, B-Series Unit |
| 16 . . . . . | 16 API Gear Reducer |
| 53 . . . . . | 5,300 lbs. Structural Capacity |
| 30 . . . . . | 30" Stroke Length |
| B* . . . . . | Beam-Type Unit |

* Company designation

Using the API method, it is easy to see the ratings of these new C-E units:

| | | |
|---|---|---|
| DB16-53-30B* | DG57-109-48 | DB160-169-64 |
| DC25-67-36 | DF80-109-48 | DB160-200-74 |
| DC25-67-36B* | DF80-133-48 | DC228-200-74 |
| DB40-89-42 | DF80-133-54 | DC228-246-86 |
| DB40-89-42B* | DD114-133-54 | DB320-246-86 |
| DG57-109-42 | DD114-169-64 | DB320-298-100 |

*Beam Balance Unit

# IN ADDITION . .

## *C-E Unit Pumpers Retain These Time and Field Proven Features*

**GROUND LEVEL COUNTER-WEIGHT ADJUSTMENTS** are even safer with these better balanced, larger units.

**FOUR-LEG STABILITY** of samson post design eliminates bearing failure caused by 3-leg unsteadiness.

**CENTER IRON** uses a heavy-duty needle roller bearing with slotted holes and jack screws to provide well adjustment of walking beam.

**CENTRALIZED LUBRICATION** makes lubrication a safe, one position operation. Pre-lubrication is an optional.

**TWO TYPES OF HORSEHEAD** are available . . removable or hinged.

**SERVICE BRAKE** is a powerful, internal expanding type. Brake now located opposite drive sheave for easier brake adjustment and repairs.

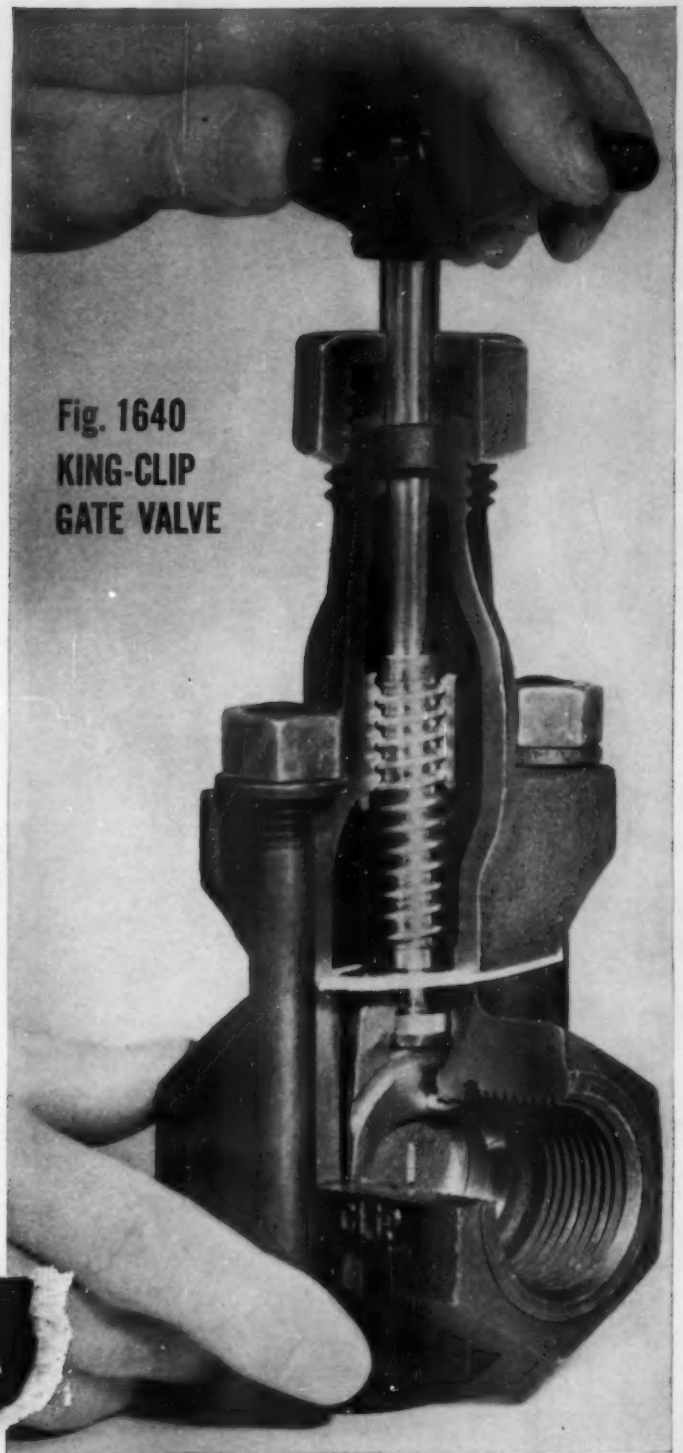
**VARIETY OF BASE AND SKID EXTENSIONS** meets all prime mover requirements and terrain conditions.

*For Service that Sings .. Equipment that Hums .. Go ..*

**CONTINENTAL-EMSCO**

*Serving the Oil and Gas Industries ... Worldwide*

Litho in U.S.A.




# NOW you can SEE why

## THE ORIGINAL KING-CLIP® VALVE by LUNKENHEIMER CUTS MAINTENANCE

Feature-for-feature, it's easy to *see* why King-Clip outperforms other clip valves . . . keeps maintenance costs low. Its precision-machined *Stemalloy® stem* assures longer stem thread life. *Seats and discs* are precision fitted to assure tight closure, even through thick liquids. *Extra-long pipe threads* extend deep into the body for pressure-tight connections. *Bodies* are rigid and extra-sturdy. And the exclusive *Non-Slip® handwheel* makes opening and closing easy—even with wet or oily hands.

Your Lunkenheimer Distributor will be glad to show you the important differences between King-Clip and other clip valves. He will arrange a comparison test that will show why King-Clip cuts maintenance costs . . . assures longer-lasting service. Or write The Lunkenheimer Co., Cincinnati 14, Ohio.

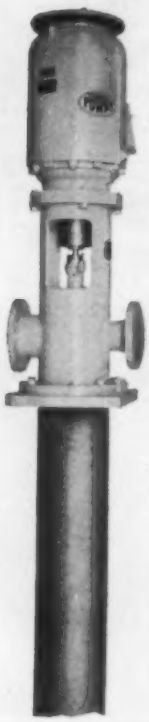
LUNKENHEIMER® QUALITY

LUNKENHEIMER®

THE ONE *Great* NAME IN VALVES

# to quench a big thirst—

PEERLESS PUMP



"Fill it up!" and nearly 60 million automobiles take an annual 56 billion gallon drink. Helping to "set 'em up again" for aircraft, automobiles, L-P gas and diesel engines, virtually every type transportation, is the Peerless Hydro-Line® vertical pump. Available in two basic types, process and transfer, the Peerless Hydro-Line is serving in the handling of hydrocarbons such as gasoline, butane, propane, hot oils, etc.; hot or cold water; mild acids, basic and salt solutions. This flexibility of application, plus its space-saving vertical design, its outstanding NPSH (net positive suction head) characteristics and its ready adaptability to future system requirements, has made the Peerless Hydro-Line truly one of America's most versatile pumps. For complete information on the Peerless Hydro-Line vertical pump line, write for Bulletin No. B-1700.

*Putting Ideas to Work*

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FOOD MACHINERY AND CHEMICAL CORPORATION

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**Peerless Pump Division**

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DOW | HERBICIDES

*Where there are weeds, there's a business hazard*
*. . . eliminate them with low-cost, long-lasting* **GARLON**

Weeds and grasses create potential fire hazards . . . speed up decay and rusting . . . prevent easy inspection of pipelines, valves, and security fences . . . and provide a perfect hiding place for rodents (and lost tools and equipment). You can cut them regularly, but that's the expensive way to use maintenance man-hours.

*Professional contractors prefer* and use Garlon*, the double-duty herbicide that kills both broad-leaf weeds *and* nuisance grasses with the same mixture. Cost records show substantial savings by switching from hand cutting, or using high-priced "soil sterilants" . . . compared to spraying the low-cost way —with Garlon. Garlon kills unwanted vegetation from the top leaves to the deepest roots without depending on rainfall to wash the chemical to the roots. One application and a spot treatment usually last a full season . . . or longer.

*Mail the coupon below* for more information and/or the name of a qualified professional contractor near you. Or call your nearest Dow Sales Office. There's one in nearly every major city.

*TRADEMARK OF THE DOW CHEMICAL COMPANY

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Agricultural Chemicals Sales Dept. 208DC6-15
Midland, Michigan

☐ Please send me additional information about Garlon and modern vegetation control chemicals.

☐ Please send me the name of a qualified professional contractor in this area.

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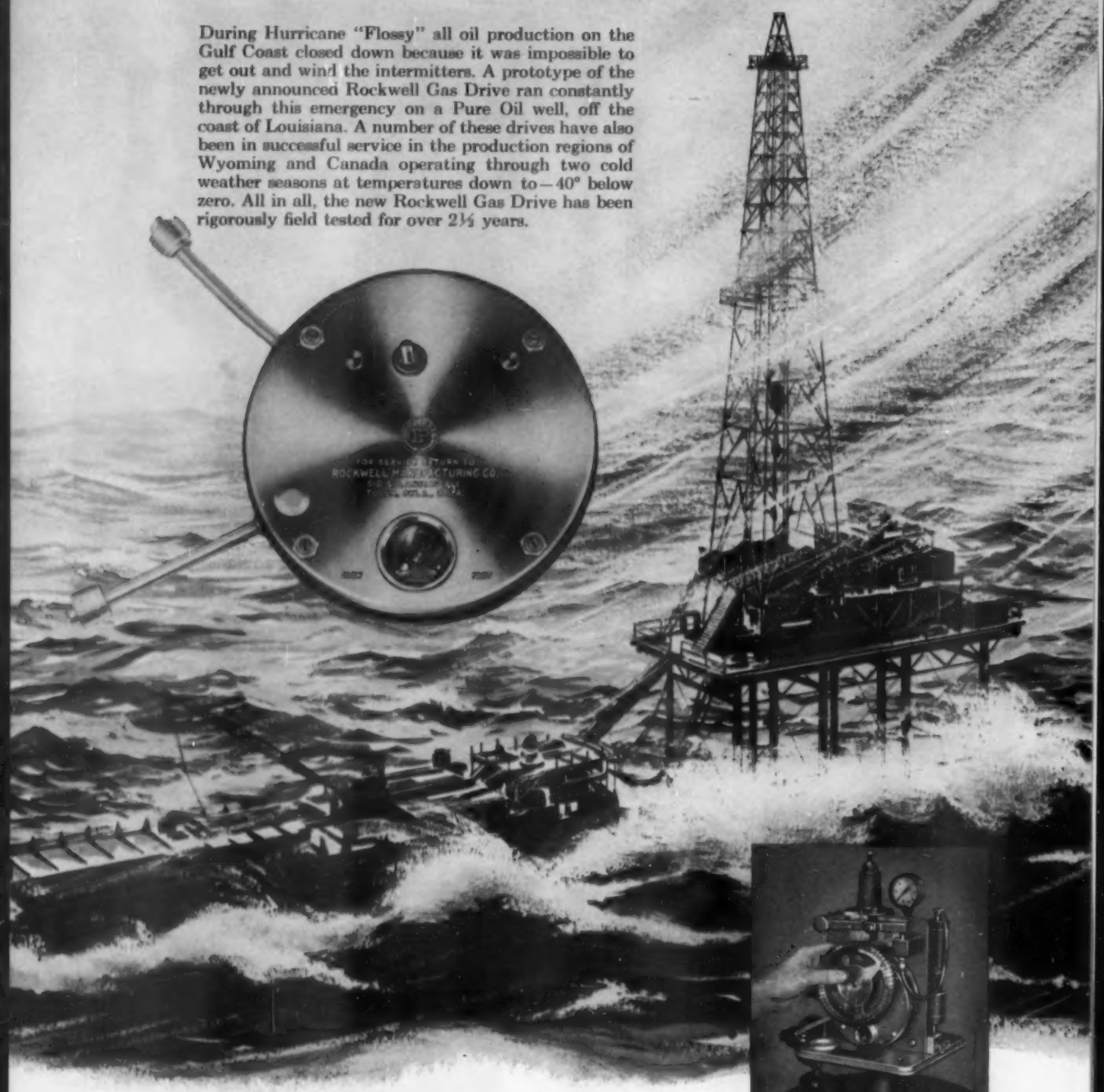
ADDRESS_____
CITY_____ STATE_____

THE DOW CHEMICAL COMPANY · MIDLAND, MICHIGAN

# The only chart drive that

During Hurricane "Flossy" all oil production on the Gulf Coast closed down because it was impossible to get out and wind the intermitters. A prototype of the newly announced Rockwell Gas Drive ran constantly through this emergency on a Pure Oil well, off the coast of Louisiana. A number of these drives have also been in successful service in the production regions of Wyoming and Canada operating through two cold weather seasons at temperatures down to—40° below zero. All in all, the new Rockwell Gas Drive has been rigorously field tested for over 2½ years.



Rockwell Gas Drive powers this typical transmitter

## FEATURES

- Powered by gas or air—no winding
- Built right into a standard Rockwell chart drive case
- Adapts to fit practically any instrument without cutting
- Uses only 4 cubic feet of gas in 24 hours
- Operating pressure range 15-25 psi

# withstood Hurricane "Flossy"

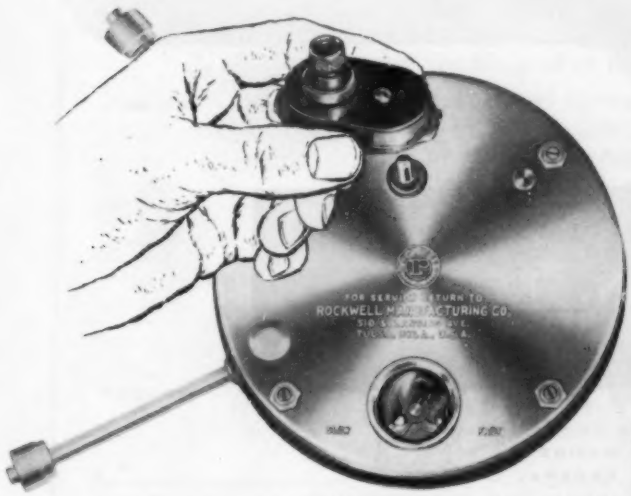
## THE NEW ROCKWELL GAS DRIVE

### A gas or air powered chart drive for all kinds of recording instruments—completely self-contained, self-starting.

Let's hope you will never need a chart drive that will run throughout a hurricane, but right now you can use the new Rockwell Gas Drive with profit to power remotely located instruments. You can forget the costly chore of periodic winding, for this drive is completely self-powered by the gas (or air) in the flowing stream.

The Rockwell Gas Drive is economical to run—it consumes only 4 cubic feet of gas every day. It's safe, too, for there is no venting problem. And it is built right into the case of a standard Rockwell chart drive and has all the interchangeability features of the spring wound design. It can be neatly fitted into practically any make intermitter, production timing instrument or recorder by using furnished adaptors for position and height. Speed changing turrets, which snap on to the main arbor, provide the utmost versatility in rotation rates. So with a stock of standard Rockwell Gas Drives, plus a selection of economical turrets, you can serve all your instrument needs.

Get full facts by writing Rockwell Manufacturing Company, Instruments Division, Pittsburgh 8, Pa.



The turret on top does the trick.

**See how easy it is to convert a Rockwell Gas Drive to any of 10 different rotation rates.**

The main arbor on this drive rotates once every 24 hours. Speed changing turrets are available to give 2-hour, 3-hour, 4-hour, 6-hour, 12-hour, 48-hour, 72-hour, 7-day, and 8-day rotation. No special tools or skills are required to convert to different rotation rates; the turrets snap into place.

GAS DRIVES, CHART DRIVES

another fine product by

ROCKWELL

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There are 18 men affiliated
with the industry on our
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Loans on oil or gas producing properties, secondary recovery, refining plants, pipe lines and many others.

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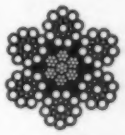
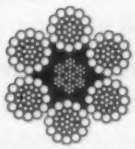
WICKWIRE ROPES
FOR
PETROLEUM DRILLING


6 x 19
Seale, IWRC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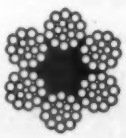
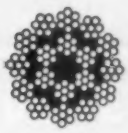
Seale, IWRC


6 x 21
Filler Wire, FC


18 x 7
Non-Spinning

***For detailed recommendations on Wickwire Ropes for drilling equipment, write the nearest CF&I sales office and ask for WR 735.***

## *For safety and performance*
## *. . . order* CF&I-WICKWIRE
## *"job-designed" wire ropes*

The Image of CF&I—a giant steelman—stands for the rigid quality-controls and testing procedures that are carried out in the production of Wickwire Rope. This Image also reflects CF&I's ability to design a specific product to meet a particular need.

These are the very reasons why CF&I-Wickwire Ropes are both *safe*—as only a *quality* wire rope can be—and *suitable*—because they are available in a *complete range* of wire grades, types, sizes and constructions, designed to meet each industry's requirements.

Avoid the losses—due to injuries and wrecked equipment—that can occur when a "bargain" rope fails. Buy a quality wire rope that's designed for the job it must do—a CF&I-Wickwire Rope.

**WICKWIRE ROPE**
**THE COLORADO FUEL AND IRON CORPORATION**

CF&I STEEL

*In the West:* **THE COLORADO FUEL AND IRON CORPORATION**—Albuquerque • Amarillo • Billings • Boise • Butte • Denver
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# MY CREWS DO A FASTER JOB with GUIBERSON SWABS

There's no substitute for a fast-falling, smooth-pulling Guiberson swab in speeding-up swabbing operations. Crews make fewer trips .. do a better clean-out job .. lift more fluid per hour. So naturally they're in and out quicker .. at the *lowest possible* swabbing cost. Match one of these cups to your swabbing job.

**TYPE J** .. lifts heaviest loads

**TYPE L** .. lifts medium or light loads

**TYPE GW** .. for light loads

**TYPE K** .. general purpose cup to 6,000 feet

**SIMPLEX** .. lifts fluid containing suspended sand

More than a third of a century of swab-making experience is behind each Guiberson swab and cup. No matter what type of production .. shallow or deep .. light or heavy loads .. smooth, rough or tight tubing .. you will pull more fluid with Guiberson swabs and cups. Regardless of your swabbing problem, you can meet it .. solve it .. quicker and cheaper with a Guiberson swab.

*Cups are compounded to Guiberson's exclusive formulas for maximum resistance to oil .. acid .. abrasion.*

BETTER BE SAFE THAN SORRY
GUIBERSON

THE
GUIBERSON
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ESTABLISHED 1919
DALLAS, TEXAS
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Sold by
Oil Field Supply Stores
Everywhere

| Well | BEFORE TREATMENT | | AFTER KONTOL SQUEEZE TREATMENT | |
|---|---|---|---|---|
| | Tubing Failures Per Year | Iron Loss (Lbs./Day) | Tubing Failures Per Year | Iron Loss (Lbs./Day) |
| A | 2 | 3.8 | 0 | 0.7 |
| B | 2 | 4.5 | 0 | 0.7 |
| C | 4 | 8.8 | 2 | 4.3 |
| D | 1 | 10.1 | 0 | 0.6 |
| E | 1.7 | 11.2 | 0 | 1.6 |
| F | 2 | 8.8 | 0 | 0.5 |
| G | 1.3 | 4.7 | 0 | 1.0 |
| H | 1.5 | 3.3 | 0 | 0.5 |
| | 15.5 | 55.4 | 2 | 9.9 |

*another*
TRETOLITE SERVICE
*report*

**87% reduction saves $52,000 annually**

# *Squeeze Application of* KONTOL* CORROSION INHIBITOR REDUCES TUBING FAILURES FROM 15.5 to 2 PER YEAR

A corrosion control program employing KONTOL substantially paid off on a Texas lease. Based on the cost of pulling wells and replacing corroded tubing, an average of $4,000 per job, the savings in one year (based on figures in table above) approximated $52,000.

### HOW KONTOL PROTECTION WAS ACHIEVED

KONTOL Corrosion Inhibitor was squeezed into the well formations at the rate of 55 gallons per well, followed by 2 quarts of TRET-O-LITE* demulsifying chemical in 15 barrels of oil, followed by oil injection sufficient to displace the liquid in the tubing and force the chemical into the formation. Injection was obtained by means of a 5 g.p.m. triplex pump and 40 g.p.m. centrifugal pump.

### COST OF TREATMENT

The KONTOL squeeze treatment cost about 70 mills per barrel of produced oil and 1.9 mills per barrel of fluid produced. This resulted in a treating cost of 17 mills per barrel less than previous corrosion prevention methods.

This is just one of many cost savings stories on KONTOL Corrosion Inhibitor treatment. For more —and information on how to start a KONTOL Corrosion Control Program—ask the Man in the Red Car. Or write to . . .

KF 59-1

*KONTOL and TRET-O-LITE are registered trade-marks of Petrolite Corp.

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**PERU:** International Gas Lift Company, Apartado 71, Talara
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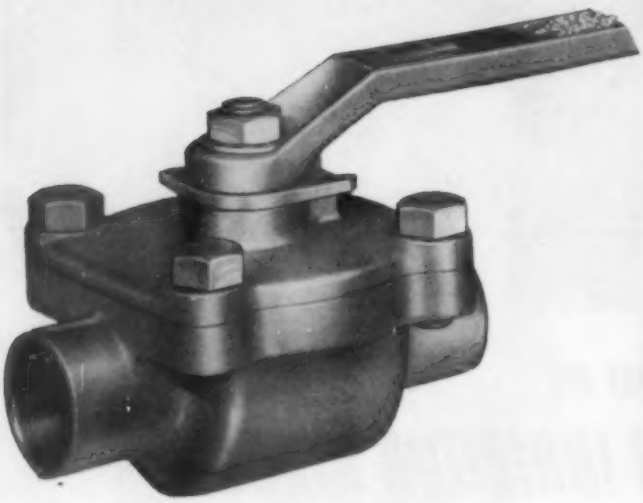
# Simple to Service ...on-the-line!



## The Rockwood Top Entry Ball Valve

Here's the advanced-design ball valve that's practically as easy to service as it is to operate. Ideal for oil, gas, oxygen, or hazardous liquids, it's a real time and money saver. Check the specifications below, then mail coupon for complete details.

*Specifications:* Cast Bronze; Buna N Seals; Forged Hard Chrome Plated Ball; Beryllium Copper Spring; Buna N Seats (also available in Teflon, nylon, and Viton-A); Sweat or Thread Ends; Sizes: ½″, ¾″, 1″, 2″; 300 p.s.i. — W.O.G.

**ROCKWOOD BALL VALVES**

*FULL, ROUND FLOW*

*Distributors in all principal industrial areas*

**ROCKWOOD SPRINKLER COMPANY**
200 Harlow Street, Worcester 5, Mass.

Please send me complete details on the Rockwood Top Entry Ball Valve.

*Name*.....
*Title*.....
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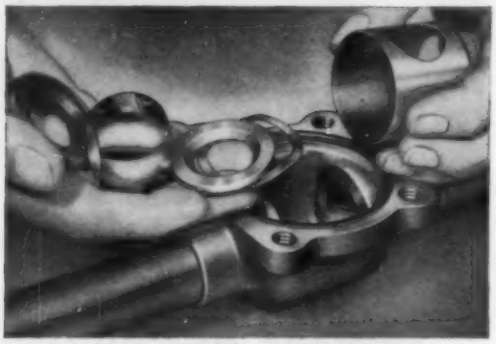
*City*.....*Zone*.....*State*.....

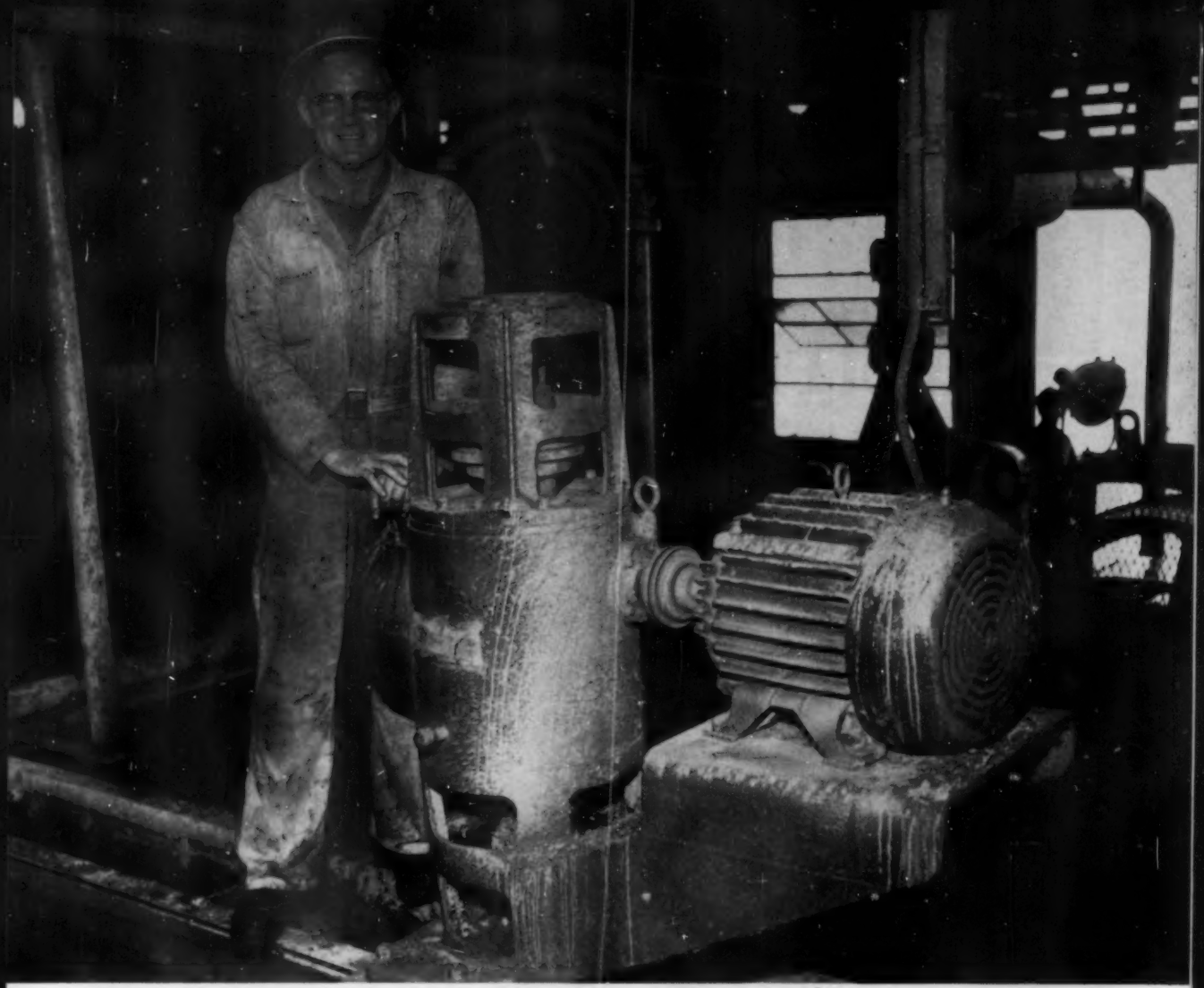
**Direction of shut-off** can be changed merely by reversing cage assembly. After removal of four screws, the body cap lifts right off, permitting access to the internal parts of the valve without removal from the line.



**Changing Type of Seat:** Cage assembly removes easily without special tools. Seat, seat retainer, spring, retainer, and ball removed as one unit for service or replacement.

**Cleaning:** Simple design and construction of body permits valve to be completely cleaned quickly and easily.

**8 Ways Easier to Handle During Installation and Operation, Too** — because square stem design permits on-off operation in any of 8 positions. Rugged stem keys directly into floating ball.



# *How they* condition mud without pump *on "El Dorado"*

You never see a mud pump jetting mud on this giant drilling barge.

Yet mud is always ready as fast as it's wanted. Every gallon stays at the right weight and viscosity. Tool Pusher C. C. Parsons can get heavier mud when he needs it—*in seconds.*

LIGHTNIN Mixers keep mud flowing and mixing powerfully in the tanks of "El Dorado" as it probes beneath Mexican waters in the Bay of Campeche.

"Whenever we check, we find weight material in perfect suspension," says Parsons. "The mixers run constantly without trouble." And wear on the mud pumps is down to a minimum.

**No third pump needed.** Right off the bat, you start saving money when you equip your mud tanks with LIGHTNIN Mixers. On most rigs the mixers make the purchase of a third mud pump unnecessary!

From the start, you get faster drilling, too—more feet of hole per dollar invested. Mud gets into top condition fast, and stays that way. You eliminate long, costly waiting. When you need to, you can heavy up mud *in seconds.* Weight and gel additions disperse as fast as you dump them in.

**See for yourself** how LIGHTNIN Mixers are cutting costs, stepping up productivity on rigs near you. Your LIGHTNIN representative will gladly arrange a field trip for you. You'll find his name in Composite Catalog. Call him now—or write us.

**EXPLORING** Mexico's first offshore field, "El Dorado" barge is being operated by Perforaciones de Mexico, S.A., drilling contractors, for Pauley Pan American Petroleum Co., under exploration agreement with Petroleos Mexicanos.

"Lightnin" Mixers

MIXCO fluid mixing specialists

**MIXING EQUIPMENT Co., Inc., 174-f Mt. Read Blvd., Rochester 3, N. Y.**

*In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Ave., Toronto 19, Ont.*

# Aluminum Electrical Equipment

Serves Longer with Less Upkeep in Chemical Process Installations
Aluminum Bus weighs less, costs less than equivalent copper systems. Installation is easier, less costly—and maintenance is lower because Reynolds Aluminum resists corrosion, won't rust.
The Finest Products Made with Aluminum
are made with
REYNOLDS ALUMINUM

Equipment made with aluminum serves longer with less attention, looks new longer with less protection. Aluminum conductors are much lower in cost than copper conductors with the same current-carrying capacity. Aluminum won't rust, and it resists corrosion. It's the *lowest-cost* corrosion resistant metal.

These are the big reasons more and more electrical equipment is made with Reynolds Aluminum —and why this equipment is preferred for chemical processing installations.

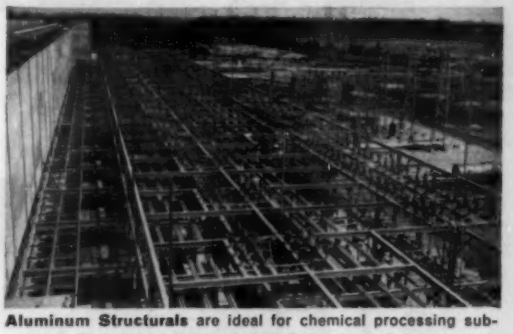
And there are other reasons, just as important. Equipment and conductors made with aluminum are easier to handle, easier to install. Aluminum is about one-third the weight of steel, or copper.

Aluminum's electrical properties can improve the performance of your electrical systems, too. Aluminum conductors often carry more current, and have excellent thermal conductivity, as well. Voltage drop may be lower with aluminum, and aluminum is non-magnetic, non-sparking.

For an electrical system or electrical equipment that will perform better, require less maintenance, and cost to install, specify conductors and equipment made with Reynolds Aluminum for the following applications . . . substations (structural members and conductors), wire and cable, cable trays and interlocked armored cable (sheathing and conductor), bus duct systems, bus bar or tube (available silver plated or bare), rigid conduit, metal enclosed switch gear. And you'll find tough, corrosion-resistant Reynolds Aluminum can cut your costs and improve plant appearance in a wide range of chemical and petroleum processing applications: jacketing, heat exchangers, tanks and vessels, piping, even drilling equipment.

Contact your local Reynolds branch office for details, or write *Reynolds Metals Company, P.O. Box 2346-CR, Richmond 18, Virginia.*

**Aluminum Rigid Conduit** is now competitive with steel in initial cost, and lower in installed cost. 10 ft. length, 3 in. size, weighs just 27 lbs., compared with 69 lbs. for steel. It's non-magnetic, non-sparking, non-rusting.



**Aluminum Structurals** are ideal for chemical processing substations. Their light weight cuts installation time, their corrosion-resistance adds years of service.

**Interlocked Armor Cables and Cable Trays** made with aluminum can be installed much faster than equivalent steel systems. Corrosion-resistant, non-magnetic, as well.

# REYNOLDS ALUMINUM

*Write today for free brochures on Reynolds Aluminum in electrical applications.*

Watch Reynolds TV show **"WALT DISNEY PRESENTS"** every week on **ABC-TV**

**Reynolds Metals Company**
**P.O. Box 2346-CR, Richmond 18, Virginia**

Gentlemen: Please send me the brochures I have checked below.

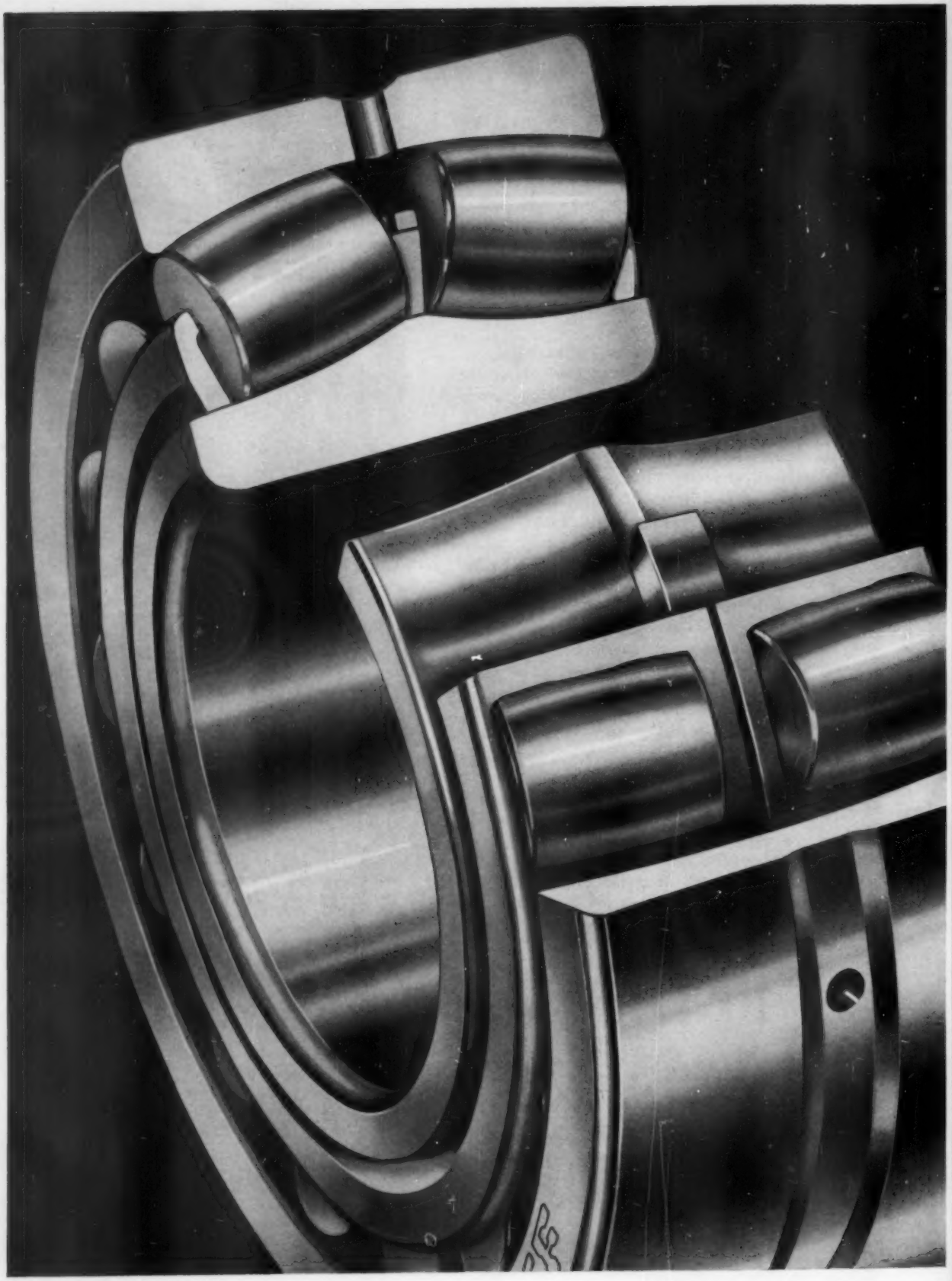
- ☐ "Reynolds Aluminum in the Electrical Industry"
- ☐ "Silver Plated Bus Bar"
- ☐ "Aluminum Rigid Conduit"
- ☐ "5005 All Aluminum Conductor"

Name_____

Firm_____

Address_____

City_____ State_____



# Now SKF has improved the spherical roller bearing it invented!

This new spherical roller bearing offers even higher capacity than SKF's original, self-aligning bearing – and meets the needs of today's faster, more productive machinery. In some cases, the increase in capacity is as much as 54% – corresponding to more than 4 times longer service life!

## Here's how these improvements have been obtained:

1. Eliminating undercuts and integral flanges – helps provide space for larger rollers and longer effective contact between rollers and races.

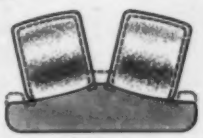


Fig. 1

Fig. 2

2. Using symmetrical rollers, unrestricted by flanges – ensures uniform load distribution over the roller length at all times, even under heavy thrust load.

3. Using an axially floating guide ring – provides effective roller guiding, and minimizes friction at roller ends.

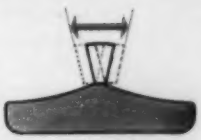


Fig. 3

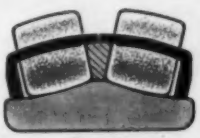


Fig. 4

4. Using a strong "window-type" cage for each row of rollers—helps ensure dependable operation over a full range of loads and speeds.

5. Placing a lubricant duct in the center of the outer ring—helps channel lubricants directly to the rollers and push contaminants away.

Fig. 5

For full details on this new high-capacity spherical roller bearing call the nearest SKF sales office or authorized SKF distributor listed in the yellow pages of the telephone book.

5931

*Spherical, Cylindrical, Ball, and "Timken" Tapered Roller Bearings*

EVERY TYPE—EVERY USE

SKF®

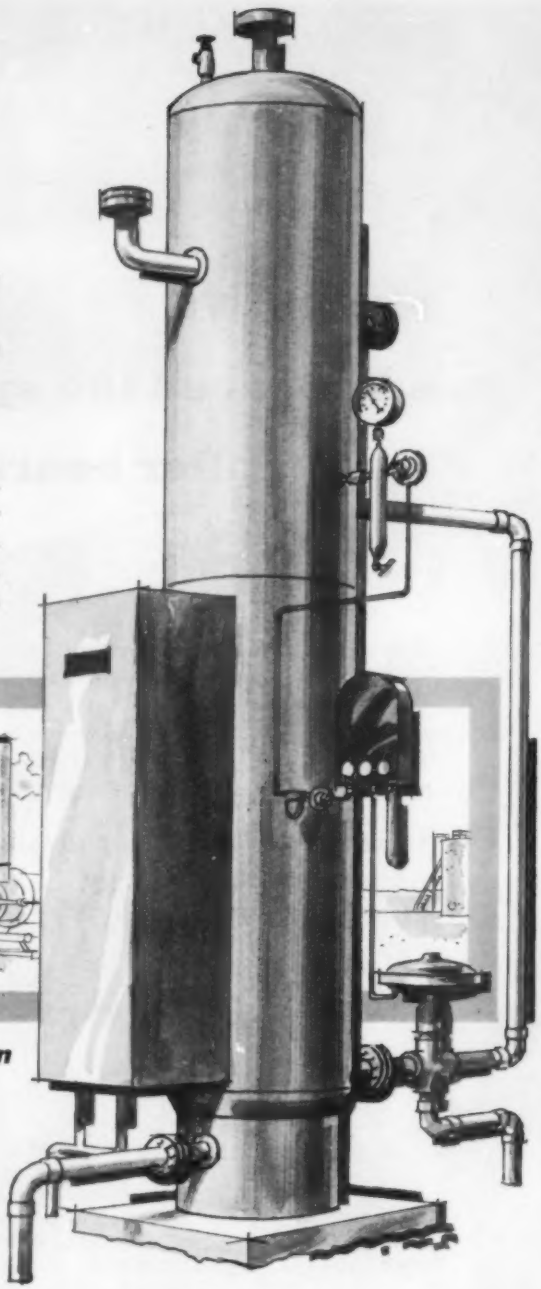
SKF INDUSTRIES, INC., PHILADELPHIA 32, PA.

*REG. U. S. PAT. OFF.

ANOTHER
**PARKERSBURG**
OUTSTANDING
ENGINEERING
ACHIEVEMENT

# ACCURACY GUARANTEED TO 99.9%

Continuous production accuracy is a must in Parkersburg Metering Equipment. The controls are easily adjusted for accurate metering calibration. Tamper-proof control house prevents meddling and Parkersburg's famous oil-field ruggedness is built into every unit.



**PARKERSBURG . . . *the FULL LINE in* METERING EQUIPMENT**

- Metering Separators
- Metering Chambers
- Metering Treaters

THE PARKERSBURG RIG & REEL CO. — PARKERSBURG WEST VIRGINIA — QUALITY PERFECTED SERVICE — MADE IN U.S.A.

Your decision is backed up when you specify **PARKERSBURG**

THE
**PARKERSBURG**
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*Division of Parkersburg-Aetna Corp.*
PARKERSBURG • HOUSTON • TULSA

See Your **PARKERSBURG** Representative Today

COPPUS BLUE RIBBON PRODUCTS

Coppus Steam Turbine with Built-In Speed Reducer

***STAMINA*** — You can literally *see* stamina in every dimension of a Coppus Turbine . . . rugged reliability that assures you stable, positive performance. It truly "wins" the Blue Ribbon with which it is marked . . . through advanced design, top quality materials, and thorough testing. With Coppus you're always certain of Blue Ribbon features such as these —

*A totally enclosed governor . . . totally enclosed, independently operated safety trip . . . easily replaceable packing and bearings . . . multiple steam nozzle control . . . brake rim for added safety . . . wide bucket "L" type wheel (optional) for minimum water rate.*

Coppus Turbines are built to customers' specifications, including API and NEMA standards. Sizes from 1 HP to 250 HP. All Coppus Products carry the same Blue Ribbon assurance of reliable performance. For further facts on turbines, send for new Catalog 200. COPPUS ENGINEERING CORPORATION, 266 Park Ave., Worcester, Mass. Sales Offices in *Thomas' Register*.

**COPPUS**
**STEAM TURBINES**

# ROILINE ENGINES

(Formerly LE ROI)

# for low cost *per horsepower dollar*

Nine H-540 Roiline Power Units pumping oil for Signal Oil & Gas Co., Huntington Beach, Calif.

First, look at the advanced V-8 design of H-540 ROILINE Engines—modern short stroke, with piston speeds much lower than comparable long-stroke units. Higher operating speeds with less piston ring and liner wear. You get *more usable horsepower* with no sacrifice of engine service life. You get fast acceleration . . . quick response . . . smooth operation with practically no vibration. You need less foundation. Shorter engines; you save space. Installation and upkeep costs are less. Good manifolding for even fuel distribution and low power loss to accessories make real fuel savings that cut operating costs. Dependable *all-ways* in all the oil fields—H-540 ROILINE Power Unit—V-8 cylinders, 4½-in. bore x 4¼-in. stroke, 540 cu. in. displacement, 155 hp at 2400 rpm burning natural gas. Send for Bulletin.

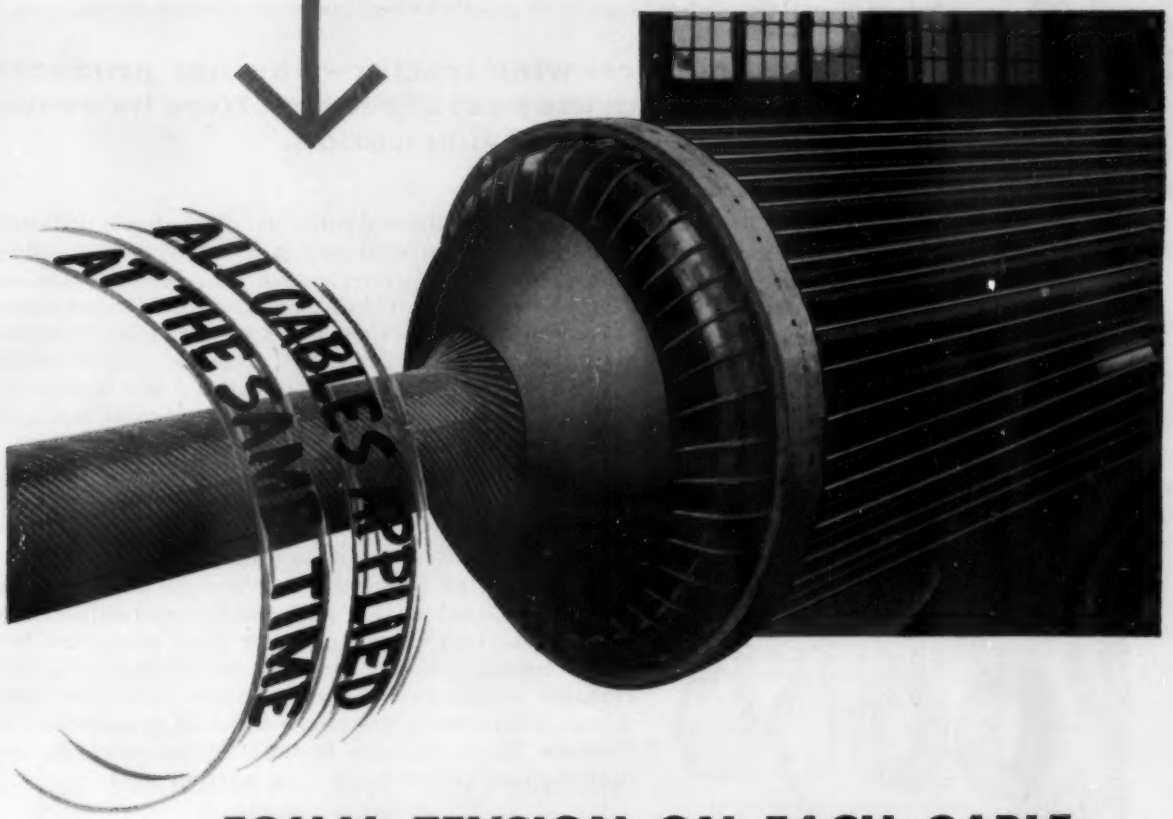
435

**ARIZONA, Casa Grande,** Engine Service Company, Inc.
**ARKANSAS, Paragould,** Wonder State Manufacturing Co.
**CALIFORNIA, Long Beach,** Engine & Equipment Company
**COLORADO, Denver,** Emrick & Hill Engine & Equipt. Co.
**ILLINOIS, Centralia,** John Nickell Company
**KANSAS, Garden City,** Carson Machine & Supply Co.
**LOUISIANA, Shreveport,** Ingersoll Corporation
**New Orleans,** Southern Engine & Pump Co.
**MICHIGAN, Reed City,** Hafer Engine Company
**OHIO. Columbus 19,** Cantwell Machinery Company
**OKLAHOMA, Chickasha,** Chickasha Gin & Mill Supplies
**Oklahoma City 9,** Carson Machine & Supply Co.
**PENNSYLVANIA, Pittsburgh 34,** P. C. McKenzie Company
**TEXAS, Houston 1,** Southern Engine & Pump Co. (also in Beaumont, Corpus Christi, Dallas, Edinburg, Kilgore, San Antonio)
**Lubbock,** Farmers Supply Company
**Odessa,** General Machine & Supply Inc.
**Wichita Falls,** Nortex Engine & Equipment Co.
**WYOMING, Casper,** Emrick & Hill Engine & Equipt. Co.

*• The trade mark LE ROI is used under license from Westinghouse Airbrake Co., the trade mark owner.*

**WAUKESHA MOTOR COMPANY, WAUKESHA, WISCONSIN / New York • Tulsa • Los Angeles**
**Factories: Waukesha, Wisconsin and Clinton, Iowa**

# Here's the reason REPUBLIC ROTARY HOSE does not develop knots




## EQUAL TENSION ON EACH CABLE

Only Republic Rubber can make Rotary Hose this way. The machine, shown here, applies all cable wires at the same time. It was designed and built in our own factory. These cables have the same tension so that pressure all along the hose will be equalized and knots or ridges cannot develop. The hose has the additional advantages of flexibility and crush resistance. Users have been generous in their praise for this hose as "the best Rotary Hose made". Stocked by J & L Supply Stores.

**SUPPLY STORES STOCK THIS AND OTHER REPUBLIC HOSE**

**REPUBLIC RUBBER DIVISION**

LEE RUBBER & TIRE CORPORATION, YOUNGSTOWN 1, OHIO

INDUSTRIAL RUBBER PRODUCTS

The Positive Seal
AC
PERMA-SAFE
Wheel

**Truck wheels, front idlers, support rollers on all models of Allis-Chalmers crawler tractors**

# Lubricated at factory need no further greasing

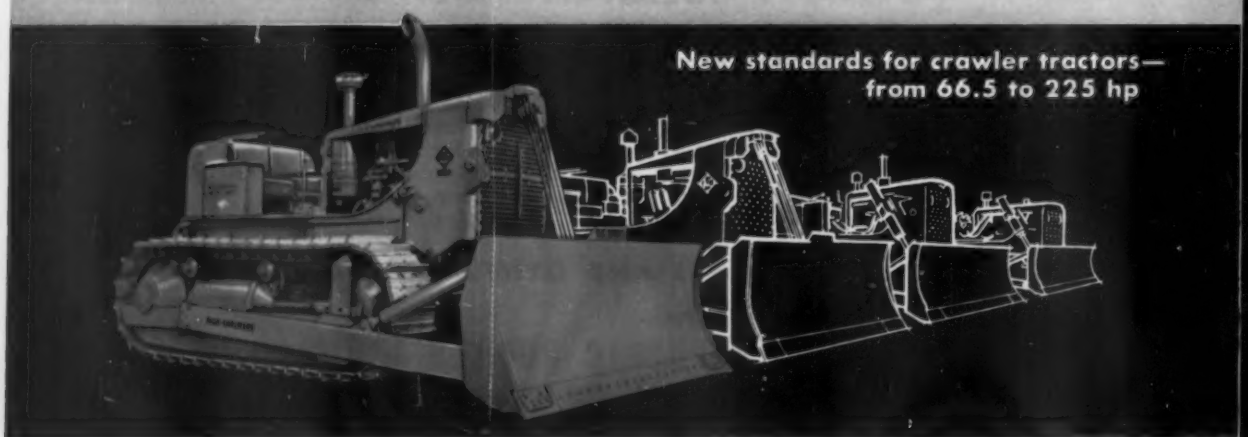
**Every Allis-Chalmers crawler tractor—whether produced today or any time during the past 17 years—offers its owner the twin secrets of permanent lubrication.**

1

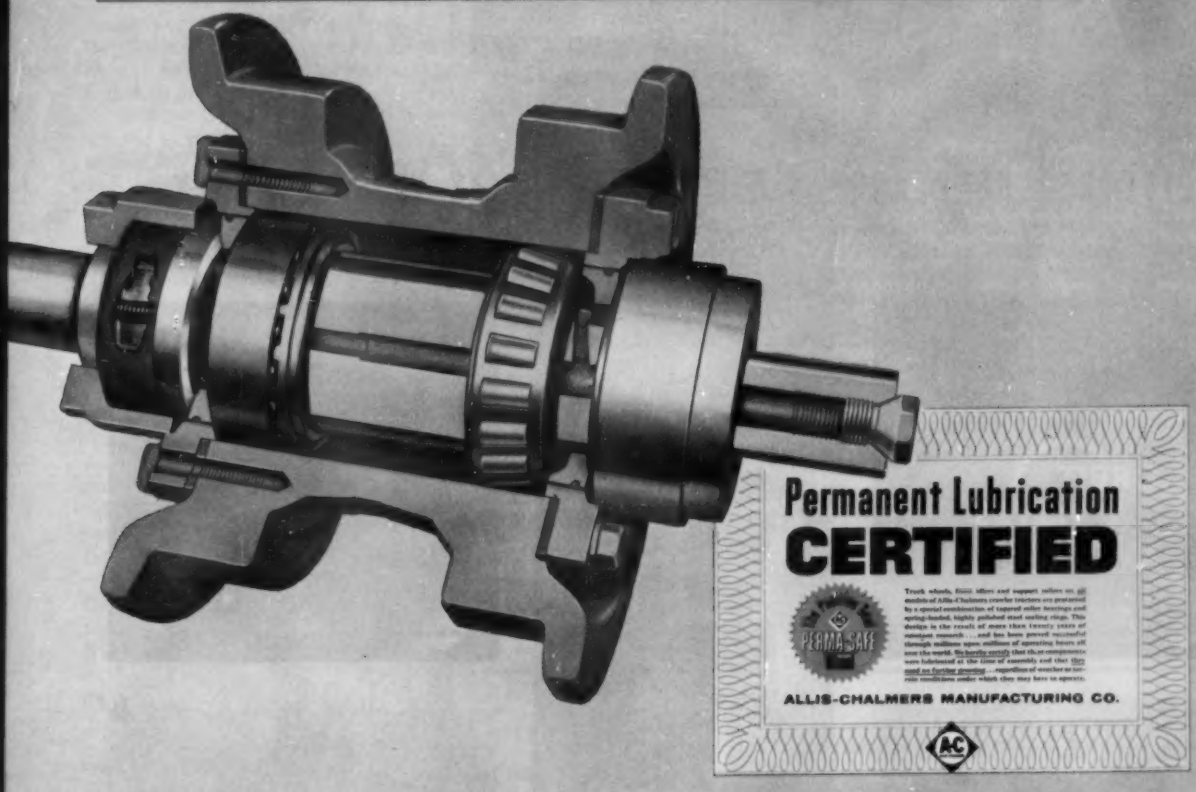
Allis-Chalmers tapered roller bearing wheels roll much more freely than ordinary bushing types . . . reduce power-robbing friction . . . give you more of your engine's horsepower at the drawbar or moldboard where it pays off in production. The tapered roller bearings maintain precise alignment of all parts . . . protect the perfect seal by minimizing side thrust and wobble . . . eliminate the uneven wear that makes positive sealing of bushing-type assemblies impractical.

2

The "Positive Seal" that makes permanent lubrication possible is effected by two steel sealing rings working in combination with the tapered roller bearings. These two rings, smoother than glass, are held firmly together by strong steel coil springs. One seal remains stationary; the other turns with the truck wheel. These seals are micro-finished to near perfect flatness. Their surfaces fit together so precisely that nothing can get through . . . a perfect seal.



Safe, permanent lubrication of truck wheels, front idlers and support rollers requires seals that will keep all moisture and other foreign materials out . . . the lubricant in. Only Allis-Chalmers offers seals which are positive because of their use in combination with tapered roller bearings. The Allis-Chalmers Positive Seal, tapered roller bearing design has been proved in the field through more than 20 years . . . through millions upon millions of operating hours. When introduced in 1938, this outstanding design replaced bushing-type assemblies similar to those used today in other tractors. Allis-Chalmers abandoned bushing-type truck wheels because, in its opinion, they could not be positively sealed.




Your Allis-Chalmers dealer will be happy to help you estimate the savings in time and material that are yours with Allis-Chalmers permanent lubrication. See him today. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

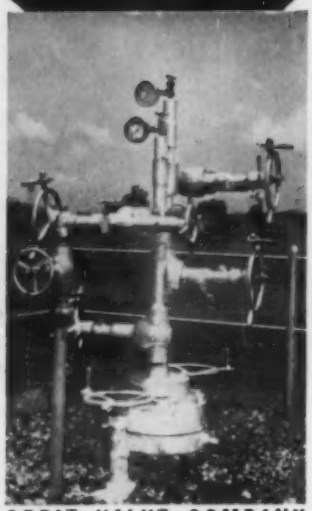
**move ahead with ALLIS-CHALMERS**

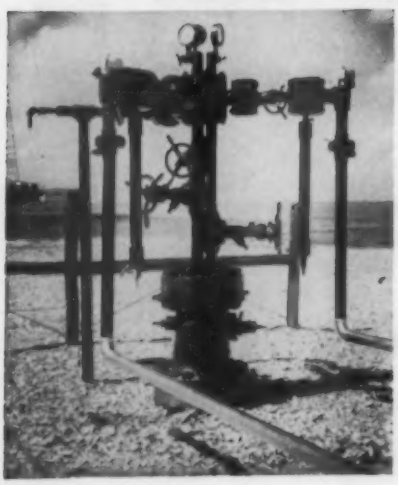
**...power for a growing world**

ECONOMICS IS BECOMING THE BIG FACTOR IN MULTIPLE COMPLETIONS. A BIG SAVINGS CAN BE REALIZED BY USING

**ORBIT FORGED STEEL RECESSED VALVES** TO CONTROL YOUR MULTIPLE COMPLETED WELLS • **ORBITS** TIE INTO THE PRESENT DISCOVERY TREND AS CLOSELY AS DO MULTIPLE COMPLETIONS • **ORBIT** FORGED STEEL PRODUCTION VALVES ARE AVAILABLE THROUGH YOUR FAVORITE WELL HEAD MANUFACTURER • WRITE FOR CATALOG 58-A FOR COMPLETE INFORMATION ON THE MANY SIZES AND TEST PRESSURES OFFERED.

## PICTURED HERE ARE 3 WAYS TO SAVE MONEY





**ORBIT VALVE COMPANY**

P. O. BOX 699, TULSA, OKLA., LU 4-4761 TWX TU 925. WAREHOUSES: Houston, Texas, 407 Velasco, CApitol 8-6623, TWX HO 115; Odessa, Texas, 402 West County Road, FEderal 7-2263, TWX ODESSA TEX 8706; Lafayette, Louisiana, 3111 Cameron St., CEnter 4-3326; Casper, Wyoming, 414 South Elm Street, Phone 2-1324; Edmonton, Alberta, Canada, 7119-104th St., Phone 391-283. WEST COAST REPRESENTATIVES: Charles Lowe Company, 383 Fourth Street, San Francisco, Calif.; Marshall E. Niedecker Company, 2785 Cherry Ave., Signal Hill, Calif. CANADIAN REPRESENTATIVES: T. R. Pickford & Company, Ltd., Calgary, Alberta, 309 7th Avenue West; Amherst 2-7371. EXPORT REPRESENTATIVE: New York 36, N. Y., 500 Fifth Avenue, BRyant 9-2236.

# They Say—

## Case for freer trade

"The forward-thinking businessman must realize that we have far more to gain from foreign trade and the prosperity of other free nations than we have to lose from the relatively small increase of foreign competition that might result from generally freer trade.

"Trade has become a potent weapon in the cold war, which is gathering momentum particularly in the less-developed areas of the world. . . .

"A further challenge to United States world leadership is posed by the liberalizing of trade barriers abroad, as in the case of the European Common Market.

"Will the U. S. continue to encourage the Common Market partners by setting the pace toward even greater and freer world trade, or, alarmed by the stiffened competition bound to come, will we timidly retreat behind our tariff barriers?

"I submit we have little alternative, if we are to discharge our obligations as leader of the free world, but to continue to practice what we have preached in Europe—the continued liberation of international trade barriers.

"Nations which have learned most readily to accommodate themselves to the growing and changing economic needs of other nations have prospered thereby—the historic record of mankind shows this."

*T. S. Petersen, president, Standard Oil Co. of California, in a speech at the annual Golden Gate World Trade Week luncheon, San Francisco.*

## Out west, a good year

"There is good reason to believe that production in western Canada will recover the ground lost in 1958 and approximate the record level of 500,000 bbl. a day attained in 1957.

"For the first quarter of 1959, production in western Canada averaged approximately 530,000 bbl. a day, an increase of 7.5% over the first quarter of 1958.

"For the second quarter of 1959, production is expected to drop to an average of about 453,000 bbl. a day, a 12% increase over the second quarter of 1958.

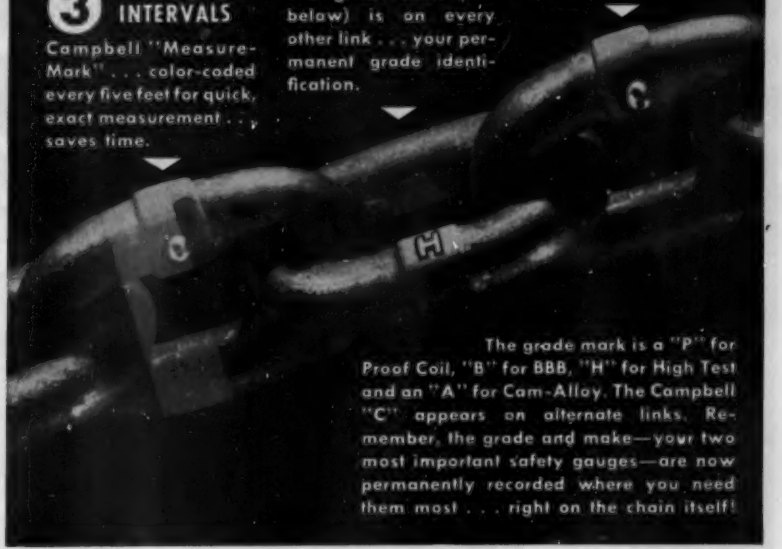
"This drop will be, for the most part, a normal seasonal decline. From the seasonal low point of the second quarter, refiners' nominations should


CAMPBELL HALL-MARK CHAIN identified . . .

1 BY MAKE
The Campbell "C" is permanently in relief on every other link . . . your Campbell identification.

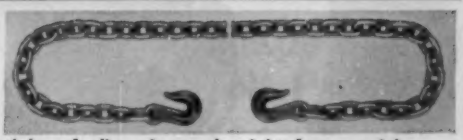
2 BY GRADE
The grade mark (see below) is on every other link . . . your permanent grade identification.

3 BY 5-FOOT INTERVALS
Campbell "Measure-Mark" . . . color-coded every five feet for quick, exact measurement . . . saves time.



The grade mark is a "P" for Proof Coil, "B" for BBB, "H" for High Test and an "A" for Cam-Alloy. The Campbell "C" appears on alternate links. Remember, the grade and make—your two most important safety gauges—are now permanently recorded where you need them most . . . right on the chain itself!

BOOMER CHAINS



Made from Cam-Alloy or High Test Steel Chain with Grab Hook each end, 20 feet long. Supplied bright finish. Packed one chain in cloth bag. In dimensions and weights for every job.

WINCH LINE CHAINS

Made from High Test Steel Chain, heat-treated for increased resistance to wear and shock loads. Tagged for size and length. Bright finish. In dimensions and weights for every job.

TRUCK TIRE CHAINS

Available in 3 grades: *Lug-Reinforced* for maximum traction and wear, *Mud-Service* for off-the-road use, *Highway Service* for general use . . . single pneumatic and dual triple.

CAMPBELL CHAIN Company

*Factories and Offices:* York, Pa.—W. Burlington, Iowa—Alvarado, Cal.

WAREHOUSES: Campbell Chain Company, 2960 Leonis Blvd., P.O. Box 58584, Los Angeles, Calif.; Koon-McNatt Storage and Transfer Co., 1100 Cadiz St., Dallas, Tex.; Campbell Chain Company, 6901 E. Marginal Way, Seattle 8, Wash.; Campbell Chain Company, 3085 N.W. Front St., Portland 10, Ore.; Campbell Chain Company, 559 West Fulton St., Chicago 6, Ill.

WEST COAST SALES MANAGER: Leonard Woods, 680 Templebar Way, Los Altos, California

TERRITORY MANAGERS: J. N. Kuhl, 7000 S. Shore Drive Hotel, Chicago, Ill.; C. W. Massey, 432 Orchid Road, Birmingham 15, Ala.; G. W. Ferree, 5634 Putnam Drive, Birmingham, Mich.; S. Adsit, 4419 W. 69th Terrace, Prairie Village 15, Kansas; A. E. Vincent, 3917 Thaxton Ave., S. E. Albuquerque, N. Mex.; K. Steinmetz, 1339 Sherwood Road, Glenview, Ill.; D. A. Ruffin, 6547 Ridgeview Circle, Dallas 30, Texas; Herman W. Froelich, 1105 S. Cordova St., Alhambra, Calif.; Peter J. Homburg, 1561 W. 111th Place, Los Angeles 47, Calif.; Morris G. Leffingwell, 244 Villa Terrace, San Mateo, Calif.; Leland M. Lenneville, 211 Oakhurst Place, Menlo Park, Calif.

CONTACT ANY OF THE CAMPBELL REPRESENTATIVES ABOVE FOR COMPLETE INFORMATION.

# Spotlighting 2 NEW VOGT VALVES

★

FORGED STEEL

INSIDE SCREW

Bolted Bonnet

GENERAL GP PURPOSE

GATE and GLOBE

VALVES

150-800 Pounds Service

2000 Pounds Cold, W.O.G.

Available from stock in ¼" thru 2" sizes and in both socket weld and screw ends.

## CHECK THESE FEATURES

1. Forged steel pressure containing parts designed for light weight and brute strength.
2. Hard faced seats and hardened discs and wedges.
3. Spiral wound stainless steel or Monel gaskets to suit trim.
4. Extra deep stuffing box for long packing life.
5. Dished sure-grip handwheel.

*Write for literature Dept. 24A-FO*

HENRY VOGT MACHINE CO., LOUISVILLE, KY.

SALES OFFICES

New York, Chicago, Cleveland, Dallas, Camden, N.J., St. Louis, Charleston, W.Va., Cincinnati

Vogt GENERAL GP PURPOSE

FORGED STEEL

VALVES

follow the normal pattern and increase steadily throughout the second half of the year."

*E. D. Brockett, president, British American Oil Co., Ltd., in a speech to company shareholders.*

## Costly fascination

"Dry holes have cost Sun Oil Co. $100 million in the last 10 years. That's equal to Sun's total investment in Canada in production, transportation, manufacturing, and marketing combined.

"The U. S. oil industry, as a whole, is presently putting $1 billion into dry holes.

"Don't get the idea that the great bulk of the dusters result from exploratory drilling. The truth is that about half of all dry holes are drilled in areas where oil has been proven, by nearby wells, to be!

"If any demonstration is needed to prove that only the drill finds oil, and that if you hope to find oil you must drill and take your chances on winding up with a dry hole, it seems to me you can't choose a better one than the thousands of dry holes drilled right in the heart of previously discovered oil territory.

"There's a certain fascination in matching wits with nature, but it takes more than fascination to put men to work looking for new oil reserves. Millions of dollars of costs are involved in the search for oil. Knowing the odds on losing that money, your backers—whether stockholders in a large oil company or a small group of investors to whom one well may spell the difference between success and financial failure—must have an offsetting incentive.

"In the case of oil men, that incentive is provided in large part by percentage depletion. Whenever I hear talk of cutting or eliminating the depletion allowance on the grounds that it is a tax 'loophole,' I wonder about the wisdom of tampering with the incentive that makes men search for oil."

*J. G. Pew, Sun Oil Co. vice president in charge of production, in an article in Our Sun, company magazine.*

## Hard sell for oil heat

"Our business is not unlike others in that it has its usual quota of pessimists. Some of the things they tell us are that many suppliers look at heating oils as a necessary evil and that they are completely disinterested in the problems of their dealers. I want to take exception to these pessimists.

"More than 50% of the middle cut

***For long-stroke units . . .***

**Now a Two-Piece "Transportable" Rod Pump for Deep-Well Pumping**

Here's a special long-stroke rod pump that's easily *carryable* to the lease. The H-F Transportable Rod Pump is designed for either hydraulic or beam unit pumping of deep wells. The barrel tube and pull rod, precision-machined and matched for an exact realignment, are broken apart and carried in two sections on the side of a car, then assembled for running in the well.

The pump is installed with a bottom lock hold-down in a standard lower seating shoe. A cup-type top hold-down seats in an upper shoe to stabilize the pump during operation. The upper hold-down also seals off the pump-tubing annulus from sand accumulation at the hold-down. The entire pump is strong and tough — sufficiently rugged to produce efficiently in deep wells.

The H-F Transportable Rod Pump, equipped with an 81-ring Flexite® Plunger, is available in 2" x 1¼", 2½" x 1½", and 2½" x 1¾" sizes, with a 32' or 38' plunger stroke.

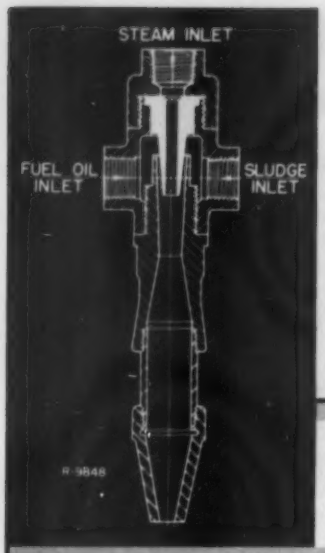
If you want to run a dependable rod pump — and get it out to the well at the very moment you're ready to run it — ask one of our factory representatives about this special new pump. Also ask the Harbison-Fischer man, your store, or write us at Box 127 for an illustrated bulletin, without obligation.

***H-F WIDE DESIGN 'FLEXITE'® RINGS*** have three times the sealing surface of regular rings, but only twice the length...ideal for deep-well pumping.

**HARBISON-FISCHER MFG. CO., Fort Worth**

*REPRESENTATIVES IN ALL MAJOR PRODUCING AREAS*

*"Best Pumps in the Oil Patch"®*



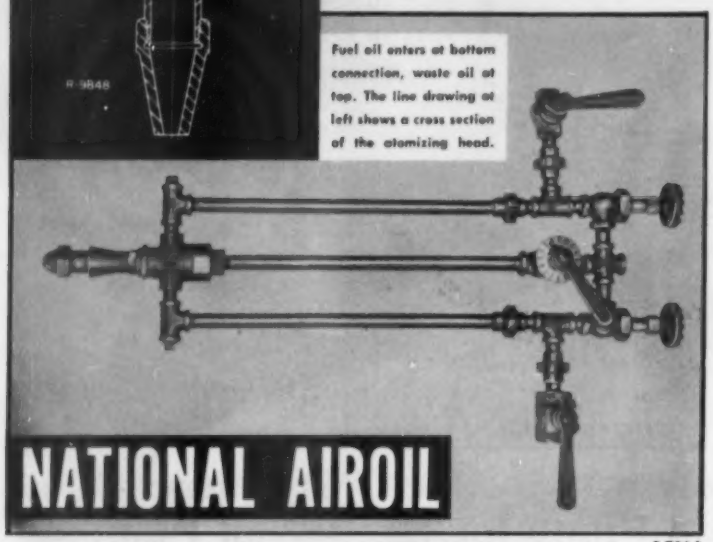

*For*

**CLEAN BURNING**

*of*

**SLUDGES AND OIL WASTES**

Fuel oil enters at bottom connection, waste oil at top. The line drawing at left shows a cross section of the atomizing head.



**NATIONAL AIROIL**

P-706-1

# TYPE S.A.D. BURNERS

**To Atomize by; Steam, Compressed Air or any Fuel Gas under sufficient pressure.**

National Airoil Burner Company recommends their patented S. A. D. Burner to improve the disposal of sludges and waste oils in furnaces or open pits in Oil Refineries, Chemical and Industrial Plants.

Type S. A. D. Oil Burners are especially designed for burning acid or caustic oils and their sludges, tank bottoms or semi-liquids of either combustible or semi-combustible nature, the disposal of which generally presents a nuisance problem.

Type S. A. D. Oil Burners will help to quickly burn these materials by admixing them with any needed proportion of regular fuel oil within the burner body and then spraying the emulsified mixture into the furnace.

Type S. A. D. Oil Burners are made standard in sizes 40, 80, and 120 U. S. gallons per hour. Larger sizes special.

Write now, on your business letterhead for Bulletin No. 21, which contains complete details, specifications and illustrations of the Type S. A. D. Oil Burners.

**National Airoil**

**BURNER COMPANY, INC.**

*Main Office & Factory:* **1236 EAST SEDGLEY AVE., PHILADELPHIA 34, PA.**

SOUTHWESTERN DIVISION: 2512 SOUTH BOULEVARD, HOUSTON 6, TEXAS


of the barrel in the United States goes into these oils. We have no intention of losing the markets they represent because of the invasion of substitute fuels if good promotion and hard selling can prevent it.

"Of course, we are concerned over the inroads of natural gas and electricity. While we are concerned, we are certain that we do have legitimate and effective ways of meeting this competition.

"Economically, heating oil is in a strong competitive position. There are no insurmountable problems of supply—not even with the coming of the jet age and the resultant increase in demand on the middle of the barrel.

"Oil has many competitive advantages. The oil user has his choice of many suppliers; there is no question of interrupted or 'partial' service when the customer uses oils; and the safety and cleanliness of oil is unrivaled.

"These and other advantages must be exploited so that markets opened to us will not be lost by default because of the aggressive promotion of gas or electricity."

*B. W. Pickard, vice president, Standard Oil Co. of California, in a speech to the Oil Heat Institute.*

## Reds overspecialized?

"Specialization in Russian engineering education is at such a high level that the curricula are designed to prepare the students to be immediately useful to industry with a minimum of additional training.

"It is the purpose of the Russian system to discourage a shift of employment from one specialty field to another.

"This results in dividing engineering education into some 150 different specialties. This contrasts sharply with the less than 20 fields that are currently accredited in the United States.

"This is not to say, however, that the U.S.S.R. system of producing highly specialized engineers should be emulated by us.

"The high degree of specialization and the standardization imposed by the authority of the Ministry of Higher Education would hardly seem appropriate for any serious consideration in this country."

*Ralph Fadum, head of the department of civil engineering, North Carolina State College, in a speech to the American Society of Civil Engineers.*

**Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.**

*Melzo, Italy. Time to start work for Renato Raggi, owner of a BP Petrol Station. By the end of this year – BP's first year in Italy – some 1500 BP stations will be in operation along Italian roads.*

BP

MUD MONARCH

SILVER TOP

# ONE OF THESE

SUPER-SERVICE

## valves and seats will cut your costs, too.

Each type of valve and seat is designed to be the best for its service. And even more, each Mission Valve and Seat is *built* to be the best. Advanced metallurgy, precision machine tools, and rigid quality control combine to cut replacement costs, to increase the efficiency of pump operation.

Mission MUD MONARCH® Valves and Seats *for extremely high and medium pump pressures.* Unique design with exclusive seal ring results in exceptional performance as this ring seals effectively when body and seats are severely worn. Compound 308® and Compound 711 inserts are available.

Mission SUPER-SERVICE® Valves and Seats *for medium pump pressures.* Four crossarms provide extra strength and large striking surface, assuring long valve seat life without restricting flow area.

Mission SILVER TOP® Valves and Seats *for low and medium pump pressures.* Replaceable, wear-taking bushing greatly reduces valve seat replacement costs. The famous Compound 308® inserts are interchangeable with Mission SUPER-SERVICE Valves.

Mission Valves and Seats are available for all popular makes of reciprocating pumps. Buy them anywhere through your supply store.

*For over thirty years - quality built in to last*

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PUMP VALVES AND SEATS • SWABS • VALVES • HAMMERDRILS • CENTRIFUGAL PUMPS

MISSION MANUFACTURING CO.

59-102

# CALENDAR

**JUNE**

**14-18** American Society of Mechanical Engineers, semiannual meeting, Chase and Park Plaza Hotels, St. Louis.

**14-19** Society of Automotive Engineers, summer meeting, Chalfonte-Haddon Hall, Atlantic City.

**15-17** Interstate Oil Compact Commission, midyear meeting, Roosevelt Hotel, New Orleans.

**21-26** American Society for Testing Materials, annual meeting, Chalfonte-Haddon Hall, Atlantic City.

**22-23** Michigan Gas Association, Grand Hotel, Mackinac Island, Mich.

**22-24** Canadian Gas Association, annual meeting, Empress Hotel, Victoria, B.C.

**22-26** Air Pollution Control Association annual meeting, Statler-Hilton Hotel, Los Angeles.

**22-26** Gordon Research Conferences, petroleum, Colby Junior College, New London, N. H.

**22-26** Massachusetts Institute of Technology, National Association of Corrosion Engineers, short course on fundamentals of corrosion reactions and corrosion control, MIT, Cambridge, Mass.

**24-25** Western Petroleum Refiners Association, Mid-Continent regional technical-industrial relations meeting, Broadview Hotel, Wichita.

**26** Southern Gas Association, compressor station conference, Dinkler-Tuwiler Hotel, Birmingham, Ala.

**29-July 3** Gordon Research Conferences, catalysis, Colby Junior College, New London, N. H.

**JULY**

**6-15** University of Michigan, short course on underground storage of natural gas, Ann Arbor, Mich.

**16-17** University of Michigan, research conference on underground storage of natural gas, Ann Arbor, Mich.

**27-31** University of Minnesota, continuation course, techniques of chemical infrared spectroscopy, Minneapolis.

**AUGUST**

**3-7** University of Minnesota, continuation course, chemical interpretation of infrared spectra, Minneapolis.

**10-13** Society of Automotive Engineers, national West Coast meeting, Hotel Georgia, Vancouver, B. C.

**12-15** Billings, Mont., Geological Society, tenth annual field conference, Disturbed Belt area of northwestern Montana, registration, August 12, Great Falls, Mont.

**24-26** West Virginia University, annual Appalachian gas measurement short course, Morgantown, W. Va.

**26-28** Pennsylvania Grade Crude Oil Association and Pennsylvania State University, twenty-first technical conference on petroleum production, Penn State campus, University Park, Pa.

**27** Oil Centennial Day, Titusville, Pa.

**SEPTEMBER**

**9-11** Pacific Coast Gas Association, annual meeting, Ambassador Hotel, Los Angeles.

**10-12** Magic Plains Oil Exposition, Borger, Tex.

**14-16** Texas Mid-Continent Oil and Gas Association, annual meeting, Rice Hotel, Houston.

**16-18** National Petroleum Association, annual meeting, Traymore Hotel, At-

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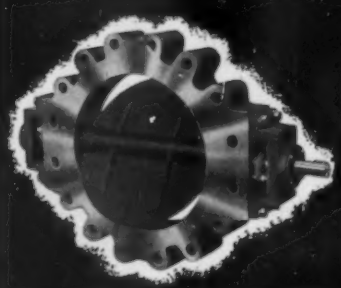

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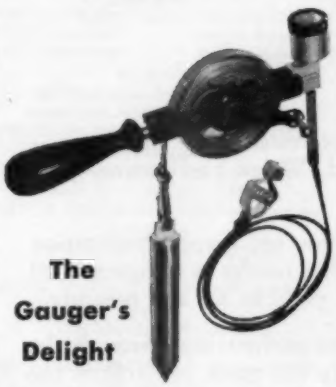

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17 Natural Gasoline Association of America, Rocky Mountain regional meeting, Wyoming-Gladstone Hotel, Casper, Wyo.

20-23 American Society of Mechanical Engineers, petroleum mechanical engineering conference, Rice Hotel, Houston.

21-25 Instrument Society of America, annual instrument-automation conference and exhibit, International Amphitheater, Chicago.

23-24 Western Petroleum Refiners Association, Rocky Mountain regional technical-industrial relations meeting, Henning Hotel, Casper, Wyo.

24-25 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division annual meeting, Roosevelt Hotel, New Orleans.

27-29 National Association of Oil Equipment Jobbers, annual convention and trade show, Hotel Leamington, Minneapolis.

29-30 Western Petroleum Refiners Association, management seminar, Western Hills, Waggoner, Okla.

28-Oct. 1 American Welding Society, fall meeting, Sheraton-Cadillac Hotel, Detroit.

29-Oct. 1 National Association of Corrosion Engineers, western region conference, Bakersfield Inn, Bakersfield, Calif.

**OCTOBER**

1-2 National Association of Corrosion Engineers, southeast region conference, Jacksonville, Fla.

2-3 Association of Desk and Derrick Clubs of North America, eighth annual convention, Hilton Hotel, San Antonio, Tex.

4-7 Society of Petroleum Engineers of AIME, fall meeting, Memorial Auditorium, Dallas, Tex.

5-7 American Gas Association, annual meeting, Conrad Hilton Hotel, Chicago.

5-7 National Association of Corrosion Engineers, northeast region conference, Lord Baltimore Hotel, Baltimore.

5-10 Society of Automotive Engineers, national aeronautic meeting, aircraft manufacturing forum, and aircraft engineering display, The Ambassador, Los Angeles.

7-8 Western Petroleum Refiners Association, fourth annual stream pollution and waste disposal conference, Broadview Hotel, Wichita.

7-10 Rocky Mountain Association of Geologists, eleventh annual field conference, Saratoga Inn, Saratoga, Wyo.

8-9 California Natural Gasoline Association annual fall meeting, Huntington-Sheraton Hotel, Pasadena, Calif.

8-10 Southwestern Federation of Geological Societies, annual meeting, Lubbock, Tex.

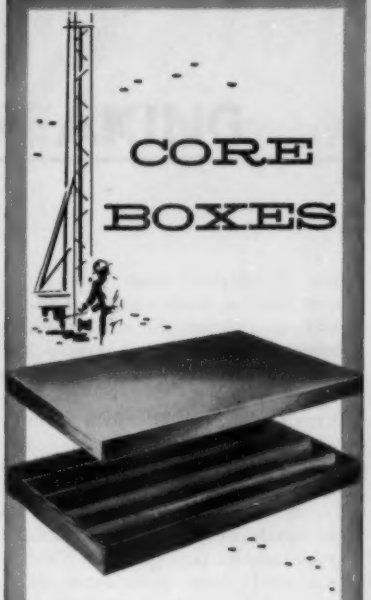
8-10 Exploration Drilling symposium, sponsored by University of Minnesota, Colorado School of Mines, and Pennsylvania State University, University Park, Pa.

8-11 Louisiana Gulf Coast Oil Exposition, Lafayette, La.

11-13 American Association of Oilwell Drilling Contractors, annual meeting, Skirvin Hotel, Oklahoma City.

11-16 American Society for Testing Materials, Pacific area national meeting, Sheraton-Palace Hotel, San Francisco.

12-15 National Association of Corrosion Engineers, south central region conference, Cosmopolitan Hotel, Denver.

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TULSA, OKLAHOMA

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# JOURNALLY SPEAKING

## Stamp of Approval?

AS IF the oil industry didn't have enough worries and causes of dissension, along comes the U. S. Post Office Department with a *cause celebre* which may keep the industry griping and arguing for months.

It is the design of the new commemorative postage stamp to be issued August 27 in connection with the industry's centennial. Here it is:

Already, as is its custom, the oil industry is dividing into factions and special-interest groups which are taking stands pro and con on various aspects of this subject.

Oil men who are stamp collectors (and there are a lot of them) say that the design should have been much more handsome, spectacular, and original.

Oil men who are experts on public relations (and aren't they all?) say the wording should have included something about oil's contributions to civilization during these 100 years.

Oil men who are artists (and there are some) say the stamp is ugly and uninspired and that they could have done better without half trying.

Oil men who are historians (and there are getting to be quite a few of such these days) say the stamp ought to depict the industry's origins and time span, such as a view of the Drake well and a modern refinery.

Oil men who are engineers (and therefore literal minded) say that better pictures of derricks can be found on almost any page of any oil publication.

Oil men who are resigned to the inevitable (call them beatniks if you will) say that that's about as much recognition of the oil industry as you could expect from the Government and we should be thankful for small favors.

And oil men who don't give a darn about industry problems (and that's probably most of them) will ignore the whole thing and continue to send out their mail through postage meters.

Which faction gets your stamp of approval? To help you choose sides on this momentous issue, here are some background facts:

Canada, which claims to have given birth to the oil industry a year before we did, got out a commemorative stamp which some people say is more appropriate than ours in every respect. Judge for yourself:

Philatelists say that a total of 412 stamps picturing or honoring the oil industry in some way have been issued by 37 countries—including some that have never produced any oil. These are collectors' items, and most of them are strikingly handsome and elaborate.

Only once before has the United States taken notice of oil on a postage stamp, and that was a California commemorative issue with a tiny picture of a derrick half hidden behind an orange tree.

The Post Office Department rejected more than 100 suggestions offered by oil men and the industry's professional artists in preference for this, shall we say, "undistinguished" design.

It hasn't yet announced the color of this stamp, but is said to be considering "a dark orange or gold, indicative of the appellation (and we shudder to use the term) 'black gold'."

*—Henry D. Ralph*

# BAKER Packers put the "permanent" in permanent-type completions

When you select a Packer for a Permanent-Type Well Completion, remember this fact: of all the tools used in permanent-type well completions, only the PACKER is required to be *permanent*. Guns, Extensions, Plugs, Gas-Lift and Circulating Valves can be removed or replaced on wire line . . . but the Packer, like the casing, is required to perform for the life of the selected producing intervals. Baker Packer Completions are *permanent completions* from the standpoint of packer performance.

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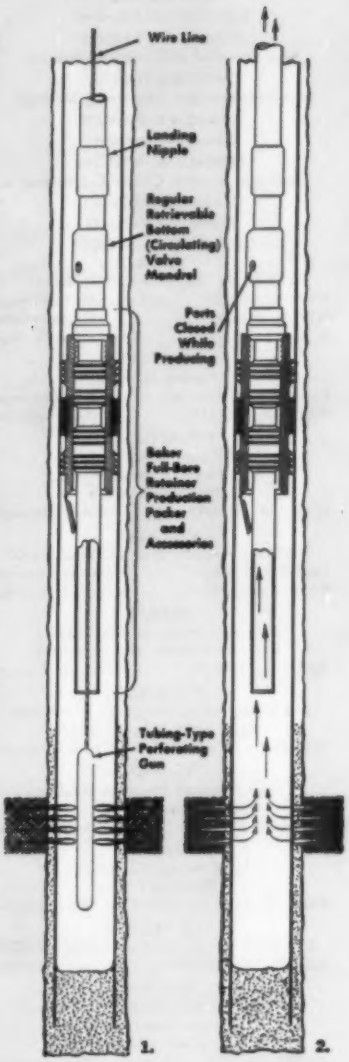


**One of the many types of Permanent-Type Completions is shown above. After perforating (1) and retrieving the cable head and collar locater, the well is put on production (2). All subsequent work-overs, such as squeeze cementing to improve gas/oil ratios, are conducted with special tools which are run through the tubing string.**

# Oil-exporting nations are now on their own

THE WORLD'S OIL INDUSTRY, outside the United States, faces a trying period in which leadership, statesmanship, and sound long-range planning are vitally needed.

It has lost the stability provided by half a dozen big international companies that were able to balance production with markets in major areas.

These companies rather effectively stabilized prices and prorated output to demand. World prices, pegged to high costs at the U. S. Gulf, kept production profitable in all areas and permitted the self-generation of capital.

NOW THESE PROPS ARE DISAPPEARING. There is production in many new areas, much of it in the hands of independent entities with only parochial interests and without established markets.

Producing capacity exceeds market demand by a big margin, while importing nations strive to build indigenous production and exporting nations are budgeting for increased sales abroad.

World price structures have been cut loose from the U. S. and are starting to drop toward a lower level. If this level comes to be based on the lowest costs of large-volume producing areas, the revenues of all exporting countries and companies will suffer.

Some producing nations are becoming aware of this possibility and are groping for a solution. They may look to the United States in vain. By imposing import controls, the U. S. has withdrawn in isolation from the world petroleum trade. Leadership must originate elsewhere.

Some exporters think the world surplus would evaporate overnight if the U. S. would reopen its market, but a look at world producing capacity shows this could not be true unless the U. S. shut in about half its production. Others want the U. S. to inaugurate world-wide proration by establishing country quotas for imports, but there is little likelihood of this.

Still others suggest an international agreement. But if the aim is a cartel to limit output, apportion markets, and maintain prices, there is no chance that the U. S. would participate.

THE BEST SOLUTION would seem to be that adopted individually by the larger oil-producing states of the U. S.—internal limitation of development and production based not on international agreement but on market prospects and prevention of economic waste. A purely advisory and educational body like our Interstate Oil Compact Commission would be a help.

This may seem too loose and imperfect to satisfy tidy-minded logicians. But in the U. S. it has worked sufficiently well to stave off the conditions that now threaten oil producers elsewhere.

The world's oil-exporting nations would do well to look to their own internal powers to rationalize and support their oil industries rather than to expect help from outside.

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# Import Volume to Rise in Second Half

**• Carson sets mandatory allowable at 1,450,362 bbl. daily for all imports. The increase stems from a 15% jump for West Coast importers and a 6% cut for rest of country where demand in next 6 months is expected to drop.**

OIL IMPORTS into the United States will be increased more than 30,000 bbl. daily in the second half of the year.

Capt. Matthew V. Carson, Jr., head of the Oil Import Administration, announced last week that the total import allowable under the mandatory program will be 1,450,362 bbl. daily from July 1 through December 31.

This total includes combined quotas for importing crude oil, unfinished oil, residual fuel oil, and finished petroleum products into the U. S. and Puerto Rico. It compares with present imports averaging about 1,416,302 bbl. daily. As indicated by Carson several weeks ago, import quotas for the second half will be down slightly in Districts 1-4 and up rather sharply in West Coast District 5.

The reduction in Districts 1-4 quotas, averaging about 6%, is due to a drop in the estimated demand for the last 6 months of the year. The Bureau of Mines estimated total demand in these districts at 8,385,000 bbl. daily. Although this represents a decline from the first 6 months of the year, Capt. Carson pointed out that it is 268,800 bbl. daily, or about 3.3% higher than for the second half of last year.

Imports into the West Coast will be up about 15% from the current level.

Quotas for Puerto Rican imports will remain at the present level pending further study, except for a decrease in the Defense Department allocation, Carson said. A public hearing on the demand-supply situation in Puerto Rico is expected to be held early in July.

Except for residual fuel oil, imports in Districts 1-4 are limited to about 9% of total demand in those districts. In District 5, they are determined by the difference between domestic supply and demand.

**Residual increased . . .** The decline in Districts 1-4 imports of crude, unfinished oil, and finished products will be offset by an increase of almost equal proportions in residual imports.

Acting Sec. of the Interior Elmer Bennett authorized an increase in residual fuel oil imports to 365,000 bbl. daily. This compares with the present quota of about 344,000 bbl. daily.

**Capt. Matthew V. Carson, Jr.**
. . . announces new import quotas.

In approving the increase, Bennett pointed out the demand for residual fuel oil in Districts 1-4 is expected to exceed domestic supply by only 330,000 bbl. daily. Higher quotas are intended to help build up year-end stocks and to meet the increased demand in event of an unusually cold winter.

Imports of residual fuel oil are set at the 1957 level, except for such adjustments which may be made at the discretion of the Interior Secretary.

**District changes . . .** In Districts 1-4 quotas for crude oil, unfinished oil, and finished petroleum products (excluding residual fuel oil) have been set at about 758,450 bbl. daily. This compares with an average of about 777,442 bbl. daily for the present quota period.

Included in the 758,450-bbl. limit for Districts 1-4 are 681,820 bbl. daily allocated for crude and unfinished oil and 76,630 bbl. for finished products.

In District 5, quotas are set at 243,539 bbl. daily. Crude and unfinished oil account for 232,920 bbl. a day, an increase of almost 33,000 bbl. daily. Finished-product allocations total 6,753 bbl. daily, and residual fuel oil will account for 3,866 bbl. daily.

The West Coast figure does not include some 22,005 bbl. daily of oil imported quota-free from Canada. With the addition of these "overland" shipments, actual imports into District 5 will total about 265,500 bbl. daily.

Allocations for Puerto Rico include 80,883 bbl. daily of crude and unfinished oil, 354 bbl. daily of finished products, and 2,140 bbl. daily of residual fuel oil.

"Because of conflicting assertions of the present importers in Puerto Rico," Capt. Carson said, "It is impossible at this time to determine whether adjustments should be made in allocations."

**Some exclusions . . .** Quotas announced by Carson do not represent total imports for the next 6 months because large volumes of oil are allowed to enter without quota or under special exemptions.

The 1,450,362-bbl. daily total includes 3,140 bbl. daily special quotas allocated by the Oil Import Appeals Board, but excludes Canadian imports into Districts 1-4, now averaging about 60,000 bbl. a day; about 22,000 bbl. daily of Canadian oil coming into District 5; and imports of bonded and military oil for use outside the U. S., now estimated at about 137,000 bbl. daily.

If exempted oil continues to come in at the present rate, actual imports into the U. S. and Puerto Rico during the second half are expected to total about 1,669,000 bbl. daily. This compares with U. S. imports alone averaging about 1,758,000 bbl. daily during the second half of last year, as compiled by the Independent Petroleum Association of America. Excluding Puerto Rico, U. S. imports are

# Company Import Quotas for Last Half of '59

## Crude and Unfinished Oils

(Barrels per day)
July 1-December 31

**Districts 1-4**

| Importer | Old Quota | New Quota |
|---|---|---|
| Advance Refining | 260 | 255 |
| Allby Asphalt | 260 | 230 |
| Allied Materials | 250 | 245 |
| American Petrofina | 4,050 | 3,920 |
| Anderson Prichard | 3,320 | 3,090 |
| Ashland | 11,300 | 10,870 |
| Atlantic | 40,160 | 38,000 |
| Aurora | 5,400 | 5,160 |
| Bayou State Oil | 86 | 80 |
| Bay Refining | 2,160 | 2,040 |
| Bell Oil & Gas | 2,070 | 1,980 |
| Berry Asphalt | 340 | 325 |
| Berry Refining | 570 | 645 |
| Big West Oil | 250 | 240 |
| Cactus Petroleum | 240 | 240 |
| Canal Refining | 120 | 115 |
| Calumet Refining | 250 | 210 |
| Champlin | 2,830 | 2,690 |
| Chanute Refining | 20 | 10 |
| Cities Service | 22,240 | 21,040 |
| Clark | 3,220 | 3,180 |
| Continental | 12,610 | 13,350 |
| Century Refining | 270 | 240 |
| Cooperative Refinery Association | 3,690 | 3,610 |
| Cosden | 4,080 | 3,880 |
| Cracker Asphalt | 150 | 140 |
| Henry H. Cross Co. | 330 | 345 |
| Crown Central | 3,860 | 3,600 |
| Danaho Refining | 400 | 380 |
| Dehli-Taylor | 2,840 | 3,010 |
| Delhi-Taylor—Mayfair Minerals | 540 | 705 |
| Derby Refining | 1,860 | 1,720 |
| Eastern States | 12,480 | 11,810 |
| Eddy Refining | 230 | 225 |
| Elk Refining | 500 | 470 |
| El Paso Natural Gas | 1,510 | 1,560 |
| Empire Petroleum | 490 | 460 |
| Empire State Oil | 320 | 360 |
| Evangeline Refining | 100 | 160 |
| Famariss | 170 | 160 |
| Farmers Union Central Exchange | 1,890 | 1,870 |
| Frontier Refining | 2,090 | 2,070 |
| Gabriel | 2,000 | 1,895 |
| Gladieux Oil Sales | 40 | 55 |
| Great Western | 220 | 175 |
| Gulf | 76,080 | 71,990 |
| Hess, Inc. | 7,840 | 7,420 |
| Howell Refining | 400 | 425 |
| Husky | 670 | 630 |
| Ida Gasoline | 22 | 20 |
| Illinois Farm Supply | 470 | 490 |
| Indiana Farm Bureau Coop. Association | 1,400 | 1,340 |
| Ingram | 2,800 | 2,650 |
| S. D. Jarvis Co. | 130 | 150 |
| Jet Fuel Refinery | 42 | 40 |
| Kendall Refining | 460 | 465 |
| Kerr-McGee | 3,990 | 4,050 |
| LaGloria | 1,750 | 1,670 |
| Laketon Asphalt | 220 | 240 |
| Leonard Refineries | 2,710 | 2,660 |
| Louisville Refining | 820 | 830 |
| Macmillan | 380 | 380 |
| Marvel Refining | 100 | 150 |
| Metropolitan Pet. | 1,440 | 1,310 |
| Mid-American Refining | 250 | 240 |
| Midland Cooperatives | 1,290 | 1,330 |
| Monarch | 20 | 250 |
| Monsanto | 3,150 | 3,000 |
| Murphy | 3,440 | 3,260 |
| Naph-Sol | 590 | 605 |
| National Cooperative Refinery Ass'n. | 2,870 | 2,760 |
| Northwestern Refining | 9,200 | 8,710 |
| Ohio Oil | 4,330 | 4,150 |
| Oriental | 420 | 400 |
| Osceola | 200 | 220 |
| Pennsylvania Refining | 140 | 130 |
| Petroleum Refining | 220 | 230 |
| Petroleum Specialties | 680 | 720 |
| Phillips | 16,895 | 15,960 |
| Plymouth | 3,200 | 3,240 |
| Pontiac | 5,410 | 5,250 |
| Premier | 1,550 | 1,480 |
| Pure | 13,540 | 12,900 |
| Quaker State | 930 | 960 |
| R. J. Oil | 410 | 380 |
| Rado Refining | 40 | 35 |
| M. T. Richards, Inc. | 20 | 20 |
| Rock Island | 1,610 | 1,550 |
| Seminole Asphalt | 190 | 190 |
| Shamrock | 2,270 | 2,160 |
| Shell | 22,760 | 21,570 |
| Sinclair | 42,400 | 40,120 |
| Sioux | 460 | 455 |
| Skelly | 5,010 | 4,800 |
| Socony Mobil | 45,760 | 43,300 |
| Sonneborn Sons | 160 | 135 |
| Southland Co. | 2,400 | 2,270 |
| South Penn | 1,130 | 1,090 |
| Southwestern Oil & Refining | 3,700 | 3,600 |
| Standard of Calif. | 45,520 | 43,070 |
| Standard of Indiana | 33,730 | 32,410 |
| Standard of N. J. | 49,120 | 46,480 |
| Standard of Ohio | 11,130 | 10,790 |
| Sun | 34,400 | 32,550 |
| Sunray Mid-Continent | 9,420 | 9,170 |
| Suntide | 4,140 | 4,150 |
| Sure-Seal | 48 | 45 |
| Tennessee Gas | 3,410 | 3,340 |
| Texas Asphalt | 1,600 | 1,515 |
| Texas Calgary | 190 | 170 |
| Texas City Refining | 3,200 | 3,030 |
| Texaco | 37,120 | 35,120 |
| Texas Gas | 629 | 630 |
| Three Rivers | 90 | 105 |
| Tidewater | 23,360 | 22,100 |
| Union | 400 | 375 |
| Uinta Oil Refining | 138 | 135 |
| United Refining | 2,400 | 2,270 |
| Vickers | 1,510 | 1,520 |
| Vulcan Asphalt | 210 | 25 |
| Warrior Asphalt | 120 | 135 |
| Waskom Natural Gas | 77 | 70 |
| Western States Ref. | 500 | 520 |
| Westland Oil | 170 | 165 |
| Wickett Refining | 300 | 290 |
| Wolf Head's | 210 | 200 |
| Wyandotte Chemicals | | 245 |
| **Total of New Quotas** | | **681,820** |

expected to be about 150,000 to 175,000 bbl. a day below the level for the second half of last year.

**What was changed . . .** Under new regulations adopted last week "historic" importers in Districts 1-4 will be allowed to bring in crude oil and unfinished products amounting to at least 75.7% of their last crude-oil quota under the old voluntary program. The floor in District 5 will remain at the 80% level now in effect throughout the country.

Other changes proposed by Carson 2 weeks ago were adopted with minor variations by Bennett.

Also included was relaxation of the 10% formula governing unfinished-oil imports into District 5. In the future individual importers, with advance approval, may bring in unfinished oil totaling more than 10% of their combined quota for crude and unfinished oil provided the total for the district does not exceed 10%.

New crude and unfinished-product quotas in continental U. S. are based on a revised formula, too. The revision reflects the higher estimated demand in District 5 and lower estimate in Districts 1-4.

In Districts 1-4, a refiner is entitled to a crude and unfinished oil quota ranging from 11.4% to 3.8% of his average daily refinery input. The old formula ranged from 12% for the first 10,000 bbl. of refinery input down to 4% for runs over 300,000 bbl. a day.

In District 5, the new formula ranges from 37.5% to 8%. Under the old formula, quotas amounted to 25% of the first 10,000 bbl. daily input and were graduated down to 6% for input of 200,000 bbl. or more per day.

**Some lost quotas . . .** In all, Carson assigned 225 import quotas for the 6 months starting July 1. They included one new crude and unfinished-oil allocation for Newhall Refining Co.

Eight firms which had quotas for the period ending June 30 failed to qualify for new allocations.

Those failing to get renewed quotas for crude and unfinished products include Batzer Oil Corp., Thermopolis, Wyo.; Monarch Refineries, Inc.,

**CRUDE (cont.)**

**District 5**

| | | |
|---|---|---|
| Bankline | 1,840 | 2,540 |
| Caminol | 2,240 | 2,200 |
| Century | 1,200 | 1,290 |
| Douglas | 4,140 | 6,050 |
| Edgington | 2,240 | 2,760 |
| Envoy Petroleum | 960 | 1,000 |
| Fletcher | 4,160 | 4,200 |
| Golden Bear | 810 | 1,220 |
| Golden Eagle | 1,840 | 2,400 |
| Macmillan | 1,840 | 2,350 |
| Manespo Refining | 1,120 | 1,100 |
| Mohawk | 2,360 | 3,290 |
| Newhall | 0 | 690 |
| Palomar | 400 | 400 |
| Powerine | 2,560 | 3,930 |
| Richfield | 14,630 | 21,350 |
| Shell | 24,320 | 24,300 |
| Signal | 3,200 | 3,200 |
| Socal Oil & Refining | 800 | 940 |
| Socony Mobil | 19,120 | 19,930 |
| Standard of Calif. | 27,690 | 37,260 |
| Sunland | 1,840 | 1,800 |
| Texaco | 15,440 | 15,400 |
| Tidewater | 28,400 | 28,400 |
| Union | 17,637 | 25,320 |
| U. S. Oil & Refining | 6,000 | 6,000 |
| Wilshire | 13,600 | 13,600 |
| **Total of New Quotas** | | **232,920** |

**Puerto Rico**

| Importer | Old Quota | New Quota |
|---|---|---|
| Caribbean Refining | 18,203 | 18,203 |
| Commonwealth Oil Refining | 61,944 | 61,944 |
| Gonzales Chemical Industries | 736 | 736 |
| **Total of New Quotas** | | **80,883** |

## Residual Oil

(Barrels per day)
July 1-December 31

Districts 1-4

| Importer | Old Quota | New Quota |
|---|---|---|
| Ashland | 156 | 165 |
| Asiatic | 702 | 744 |
| Atlantic | 272 | 288 |
| Ballard | 2,933 | 3,110 |
| Belcher | 1,580 | 1,675 |
| Buckley Bros. | 4,250 | 4,506 |
| Canadian National Railways | 20 | 21 |
| Central Petroleum | 3,187 | 3,261 |
| Colonial Oil | 3,744 | 3,970 |
| Eastern States | 7,112 | 7,541 |
| Gulf | 2,019 | 2,141 |
| George Hall Corp. | 356 | 377 |
| Hess, Inc. | 38,928 | 41,275 |
| Inland Terminal | 14 | 15 |
| George T. Kaneb | 25 | 28 |
| Metropolitan Pet. | 21,259 | 22,541 |
| Military Petroleum Supply Agency | 1,375 | 1,458 |
| New England Pet. | 8,523 | 9,037 |
| Paragon | 54,423 | 57,705 |
| Pure | 403 | 427 |
| Royal Petroleum | 2,510 | 4,226 |
| Shell Caribbean | 12,719 | 13,486 |
| Shell Oil | 4,014 | 4,256 |
| Sinclair | 286 | 303 |
| Socony Mobil | ..... | 269 |
| C. H. Sprague & Son | 21,495 | 22,798 |
| Standard of Calif. | 1,102 | 674 |
| Standard of Indiana | 21,683 | 22,990 |
| Standard of Kentucky | 11,066 | 11,733 |
| Standard of N. J. | 104,210 | 110,494 |
| Steuart Petroleum | 3,900 | 4,135 |
| Texaco | 850 | 901 |
| Whale Oil | 301 | 319 |
| White Fuel | 7,664 | 8,126 |
| **Total of New Quotas** | | **364,995** |

**District 5**

| | | |
|---|---|---|
| Military Petroleum Supply Agency | 3,866 | 3,866 |

**Puerto Rico**

| | | |
|---|---|---|
| Military Petroleum Supply Agency | 1,518 | 516 |
| Porto Rico Iron Works | 943 | 1,074 |
| Standard of N. J. | 497 | 550 |
| **Total of New Quotas** | | **2,140** |

## Finished Products

(Barrels per day)
July 1-December 31

**Districts 1-4**

| Importer | Old Quota | New Quota |
|---|---|---|
| Asiatic | 31 | 23 |
| Ballard Oil Co. | 1,165 | 1,165 |
| Blanchet & Fils | ..... | 3 |
| Gulf | 2,723 | 2,723 |
| Hess, Inc. | 3,234 | 3,234 |
| Leonhardt Associates | 0.3 | .20 |
| Lubrizoil Corp. | 1.1 | 2 |
| Metropolitan Pet. | 5,100 | 5,100 |
| Military Petroleum Supply Agency | 30,554 | 30,554 |
| Paragon | 1,052 | 1,052 |
| Pure | 5 | 5.50 |
| Robinson Lumber Co. | ..... | 1.25 |
| Royal Petroleum | 1,476 | 1,476 |
| Socony Mobil | ..... | 25 |
| Standard of Calif. | 6,818 | 7,284 |
| Standard of N. J. | 13,590 | 13,590 |
| Shell | 9,789 | 9,789 |
| Sun | 604 | 604 |
| **Total of New Quotas** | | **76,631** |

**District 5**

| | | |
|---|---|---|
| Alaska Propane | 35 | 35 |
| Asiatic | ..... | 8 |
| Calor Gas Co. | 2 | 2.10 |
| Fairbanks Plumbing & Heating | 9 | 3.33 |
| Military Petroleum Supply Agency | 3,876 | 3,876 |
| Shell | 186 | 185 |
| Standard of Calif. | 567 | 576 |
| Time Oil Co. | 2,068 | 2,068 |
| **Total of New Quotas** | | **6,753** |

**Puerto Rico**

| Importer | Old Quota | New Quota |
|---|---|---|
| Military Petroleum Supply Agency | 406 | 152 |
| Shell Co. (Puerto Rico) Ltd. | 57 | 57 |
| Standard of N. J. | 107 | 104 |
| Tropical Gas | 41 | 41 |
| **Total of New Quotas** | | **354** |

Oklahoma City; Gladewater Refining Co., Gladewater, Tex.; and Hunt Oil Co., Dallas.

Failing to qualify for extension of their finished-product quotas were Anchor Petroleum Corp., Oklahoma City; Western Solvents & Chemicals Co., Detroit; Peirce Brothers Oil Service, Inc., Waltham, Mass.; and Solar L. P. Gas Co., Spokane.

The Oil Import Appeals Board authorized extension of allocations which it approved for the period ending June 30. Companies involved are Texas Asphalt & Refining Co., Houston; Gabriel Oil Co., Houston; Signal Oil & Gas Co., Los Angeles; Gonzales Chemical Industries, San Juan, Puerto Rico; and Metropolitan Petroleum Co., Oradell, N. J.

**Quota challenged . . .** Eastern States Petroleum & Chemical Corp. went into Federal court last week to ask for an increase in its import quota on the grounds that its present quota is wrongly calculated.

The Houston refining company has 509,723 bbl. of imported crude in bonded storage. It told the court it will lose $1.5 million unless granted temporary relief until June 30, the close of the current quota period.

Attorneys for the company said they are not attacking the validity of the mandatory import program but seeking relief for a specific problem.

Eastern States asked for two increases to its present quota of 12,480 bbl. daily. (The quota will be 11,810 for the July 1-December 31 period). One increase would be for 3,040 bbl. daily to make up for an incorrect reporting of the company's actual imports in 1957 upon which the quota is based.

The other increase, for 9,645 bbl. daily, would cover imported crude which is refined and shipped out of the country again.

Company attorneys told U. S. District Judge Joe Ingraham at Houston that if they are not granted temporary relief, there is no way under future court decisions on the actual merits of the case for Eastern States to recover the loss. They asked for authority to import an extra 1,420,720 bbl. of crude for the period of March 11 to June 30.

# Pipelines Win Dividend-System Fight

**• Supreme Court ruling gives stamp of approval for pipeline firms to continue basing dividends to its shipper-owners on full valuation of the lines. Justices say that formula is authorized by the consent decree.**

THE SUPREME Court last week upheld the dividend-computing method used by major oil pipelines since 1941.

In a 6-1 decision, the court affirmed the right of Arapahoe Pipe Line Co. to base dividends to its shipper-owners on the full valuation of its line.

The Arapahoe case was the last of a series in which the Government had charged illegal dividend payments amounting to millions of dollars a year.

A 1941 consent decree under the Elkins Act prohibits an oil pipeline company from paying an annual dividend to a shipper owner exceeding "its share" of 7% of the carrier's property valuation.

The Government contended that Arapahoe's dividends should be based on the $2,900,000 invested in capital stock of the company by its owners, Sinclair Pipe Line Co. and Pure Oil Co. Arapahoe maintained that $26,000,000 borrowed from an insurance company should be added to the capital investment in determining valuation for dividend purposes.

Under the Government's formula, dividends to the shipper-owners would be limited to $203,000. Arapahoe claimed the consent decree authorized it to pay dividends of more than $2,000,000 a year.

The case was taken to the Supreme Court after its dismissal in U. S. District Court for the District of Columbia (OGJ, Oct. 20, 1958, p. 49).

**Majority opinion . . .** Speaking for the six-man majority, Justice Hugo Black pointed out that from 1941 to 1957 the Government accepted total valuation as a basis for dividends.

"For that 16 years the Government accepted this interpretation without challenge," the court pointed out. "Yet today it renounces this long-standing acquiescence and claims that the decree imposed limits it had not previously sought to enforce."

In 1942, less than a year after the consent decree was issued, the Government agreed to a supplemental order affecting one of the pipelines involved.

"This order approved a plan of recapitalization for the pipeline which would at least have been highly suspect under the reading the Government today gives the decree," Justice Black observed. "Significantly the supplemental order, which was agreed to by the officials who had represented the Government in drafting the original decree, expressly stated that the plan did not violate that judgment."

Although that pipeline was not involved in the Arapahoe case, Justice Black said that "the interpretation given in the 1942 order is clearly relevant to the question of what the Government thought the 1941 judgment meant at the time."

He noted that the 1941 decree required annual reports showing total earnings available to owners or stockholders of the affected pipeline and actual dividends paid. For 16 years, he added, the report indicated that dividends were computed not on the basis of 7% of the current value of the owners' investment but on the total valuation of the carriers' properties.

The controversy in the Arapahoe case centered on the interpretation to be given the word "share" in the consent decree by reading it to refer to a proportion of total capitalization rather than to the percentage of stock owned by a parent company. Justice Black agreed "the language can be made to support the United States' contention."

"But that," he said, "is surely a strained construction, and cannot be reconciled with the consistent reading

# Favored-Nation Cases Probed

**. . . by FPC in test case to determine if they can be tossed out on the grounds they are against the public interest.**

FAVORED-NATION clauses in natural-gas sales contracts face an important test before the Federal Power Commission in the near future.

An FPC examiner is scheduled to resume hearing June 29 on a Pure Oil Co. rate case in which the Commission had hoped to determine whether favored-nation clauses are "void or voidable as contrary to public interest."

Hearings started last month after the commission announced its plan to broaden the case to test the validity of favored-nation provisions in natural gas sales contracts.

Now before the commission are two motions made by Pure. One motion seeks reconsideration of the order broadening the case, and the other seeks postponement of the hearing.

Also on file is an opposing motion by the California Public Utilities Commission. It seeks dismissal of Pure's proposed rate increase on grounds that it was triggered by favored-nation provisions and is contrary to the public interest.

The rate increase sought by Pure would total only about $98,000 annually. But the FPC estimates that the case will involve annual rate increases of more than $35,000,000.

Pure is seeking higher prices for gas which it sells to El Paso Natural Gas Co. in the Permian basin of West Texas and New Mexico. The company contends that El Paso's purchases of gas from West Texas Gathering Co. activated favored-nation provisions of its rate schedules. Gas involved is produced in Upton and Crockett counties, Texas, and Lea County, New Mexico.

Under a favored-nation clause, a producer is entitled to a higher price for his gas to match the rate later paid to another producer in the area. The long-established practice establishes certain purchasers-for-resale as actuating centers for a multitude of increased rates, the FPC pointed out.

**Effect considered . . .** The FPC indicated it wants to study the effect of

given to the decree, by both the United States and appellees, from the date it was entered until 1957—about 16 years."

The majority opinion noted that the Government contended its interpretation would more nearly effectuate "the basic purpose of the Elkins and interstate commerce acts that carriers are to treat all shippers alike."

"This may be true," the majority agreed. "But it does not warrant our substantially changing the terms of a decree to which the parties consented without any adjudication of the issues."

If the 1941 consent decree had meant to limit dividends to 7% of the current value of a parent company's actual investment in a subsidiary, the opinion added, "one can hardly think of less appropriate language in which to couch the restriction."

The majority refused to reject the traditional interpretation of the decree "simply because another reading might seem more consistent with the Government's reasons for entering into the agreement in the first place."

Justice William Douglas was the only member of the court to dissent to the majority opinion.

Service Pipe Line Co. and Tidal Pipe Line Co. also were involved in the case when it reached the Supreme Court. Both were dropped from the case on motion of the Justice Department in March. At that time, Service stipulated that it would exclude from its valuation additions to its system prorated to midyear. Tidal agreed to exclude leased property from its valuation for dividend purposes.

such rate increases, both on manufacturers and on the cost of living borne by the public.

Manufacturers and consumers have a limited ability to turn to other sources of fuels or energy, the commission noted. And they have a correspondingly limited capacity to assert a dampening effect on rising prices or upon the alleged pyramiding of prices attributed to favored-nation provisions.

The commission said that widespread use of favored-nation devices, the successive claims of their being activated, and their broad national effect "give cause for grave concern."

In announcing its procedure in the Pure case, the regulatory agency said that the conception, operation, and effect of favored-nation agreements "raise the question of whether such provisions are void or voidable as contrary to public interest."

## watching WASHINGTON

Joe Reilly

### • Celler rebounds, drafts bill to kill "rebates" . . .

REP. EMANUEL CELLER (D-N.Y.) HAS LOST a battle in his attack against oil pipelines. But he still hopes to win the war.

The Brooklynite suffered a setback last week when the Supreme Court upheld Arapahoe Pipe Line Co. in a test case involving the amount of dividends which shipper-owners may collect from their pipeline interests.

Even before the court ruled, however, Celler was preparing a bill to clamp down on what he called "rebates" to shipper-owners. His bill would amend the Elkins Act. It defines a rebate to include dividends paid by an oil pipeline to its principal shipper from the money paid by that shipper for transportation services.

As Celler explains the bill, it would curtail dividend payments "in lieu of divorcing oil pipelines from the ownership and control of the major integrated oil companies." But industry observers see such legislation as a sure step toward divorcement. As one pipeline spokesman put it, "ownership of property without right of return has no basis in economic reason."

The Elkins Act, passed in 1903, outlaws discriminatory rebates in shipments by common carrier in interstate or foreign commerce. In 1940 the Justice Department decided that dividends paid to shipper-owners of pipelines amounted to rebates. It filed suit against three companies, and more than 50 other complaints were prepared for filing.

NONE OF THE CASES EVER WENT TO TRIAL. They were settled by the 1941 consent decree. It allowed a pipeline company to pay a shipper-owner an annual dividend equal to "its share" of 7% of the carrier's property valuation.

The decree, as approved by federal court, involved 78 oil firms. Negotiated by a Democratic administration, it caused hardly a ripple in Washington for nearly 16 years.

In 1957, after the Republicans had captured the White House and the Democrats again had gained control of Congress, Celler's antitrust subcommittee started its long investigation of consent decrees.

Shortly after Celler announced his investigation, the Justice Department filed suits against four pipeline companies. Each case contested the method used in determining valuation as a basis for dividends.

Celler thought it was "significant" that the suits were not filed until after his subcommittee had announced that it would hold public hearings on the Justice Department's enforcement record.

The Celler subcommittee investigated long and hard. Record of its hearings on pipelines alone covered more than 1,600 pages. But in the end, the subcommittee was unable to agree on its findings.

Its report to Congress was held up for months because of dissension.

IN THE MEANTIME, SETTLEMENTS were reached in three of the four pipeline cases filed in 1957. The fourth case, against Arapahoe, had been dismissed by one court and was appealed to the Supreme Court.

The Supreme Court took the case under advisement in April. The next month, Celler released the long-awaited report of his investigation.

In fact, he released two reports. Neither was signed by a majority of the subcommittee. Celler and three other Democrats issued one version, in which they blistered the Justice Department, the Interstate Commerce Commission, oil pipeline companies, and various other segments of the industry. The three Republican members put out another version, charging that their Democratic brethern had "labored mightily and brought forth a mouse." Two other Democrats refused to sign either statement.

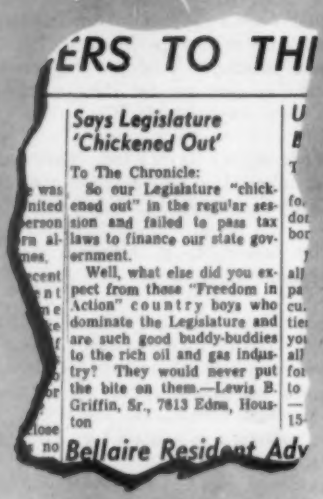
In their report, Celler and the three Democrats who stuck with him summarized the Justice Department's arguments in the Arapahoe case. Lest their motives be misunderstood, they added: "The committee, of course, in this report does not express any opinion with respect to the issues involved in any pending litigation."

# Texans Organize to Answer Oil's Foes

- New committee set up by Texas Mid-Continent Oil and Gas scans newspapers and other media for criticisms. Committee members fire back answers in an effort to tell oil's story better.
- Those who praise the industry or want answers to puzzling questions also are served by this new group.

## How the New Committee Works:

**This letter to the editor resulted in this answer.**



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**Says Legislature 'Chickened Out'**

To The Chronicle:

So our Legislature "chickened out" in the regular session and failed to pass tax laws to finance our state government.

Well, what else did you expect from these "Freedom in Action" country boys who dominate the Legislature and are such good buddy-buddies to the rich oil and gas industry? They would never put the bite on them.—Lewis B. Griffin, Sr., 7813 Edna, Houston

Bellaire Resident Adv

To the Chronicle:

Mr. Lewis B. Griffin, Sr., who says the Legislature would never "put the bite" on the "rich oil and gas industry" seems to lack any information whatever on who is currently paying the biggest share of our state taxes. Last year the oil and gas industry paid $198 million into the state treasury in taxes. This does not include one penny in sales taxes paid on its products either...It doesn't seem they (the oil and gas producers) have the immunity to taxation that Mr. Griffin thinks they have.

UNJUST criticisms of the petroleum industry no longer go unanswered in Texas.

Neither do honest questions posed by Texans, who are unfamiliar with the industry.

And, on the other hand, those who say something nice about the industry are at last being recognized and thanked.

Credit for all this goes to a new "Meet the Critics" program launched early this year by the Oil Information Committee of the Texas Mid-Continent Oil and Gas Association.

The program began as a project of the women's division of the OIC. It caught on quickly. And it now has been expanded to become a permanent function of the organization's 342 local committees in as many Texas cities and towns.

Here's how it works.

Each community committee of the OIC is responsible for monitoring newspapers, magazines, and other communication media for brickbats, praise, or simple questions directed at the industry. Letters to the editor, editorials, and columns are watched closely.

Clippings are mailed quickly to the Dallas OIC headquarters. The matter at hand is researched, an answering letter drafted, and the letter mailed back promptly to the local committee. The letter is signed by an individual member of that committee and sent in to the pertinent publication.

Angry, scathing-type letters are taboo. Only accurate, logical, temperate replies go out.

**Picking up steam . . .** As might be expected, the program started rather slowly. As committee members learn to condition themselves to watch for criticisms of the industry, however, clippings are arriving at the Dallas headquarters in increasing numbers.

Clippings now average around a

dozen a week—of which possibly four or five can be answered. These primarily concern such broad issues as gasoline prices, depletion, oil and gas taxes, "stinking refineries," and pollution.

Jack Robinson, associate director of OIC in Dallas, says the committee feels it has to restrict its answers to the general type of criticism, as against the type of situation in which an individual oil company is flayed due to its fuss with a city council or a county assessor. Criticisms must be broad.

The Texas committee thinks that it is not equipped either to deal with unjust slams by syndicated columnists which might appear in hundreds of newspapers over the nation.

Acclimating the local committees as to the kind of clippings desired has proved about as tough a job as getting them to send clippings in the first place. But it is progressing.

Along with being thorough, the Texas committee feels it vital to be prompt. If answers do not follow hard on the heels of the criticisms, they likely will go unused by newspaper editors.

The committee hopes, thus, to expedite handling and answering by building up a stock of answers to the criticisms seen most. These will be filed by categories. And they can be rewritten slightly to the particular need and sent out quickly.

**Why in Texas?** . . . It is not uncommon for oil men in Texas and other producing states to write off lightly such public-relations efforts in the oil states.

Their reasoning is that oil's public relations are much worse in the North and East, thus that oil should perhaps scale down its efforts in producing areas to concentrate on the more-populous nonproducing regions.

The Texas OIC has answers here, too.

Two, it says, stand out. First, by its very location in the state, the oil industry is more vulnerable to taxation and restrictive legislation than in areas where it doesn't exist. Secondly, what oil men and women do in Texas can be helpful to other oil groups working elsewhere in the country.

# Another Intrastate Gas Line Planned

TEXAS ELECTRIC Service Co., big Texas utility, confirmed officially last week that it will build a new $25,000,000 gas line from Old Ocean field on the Texas Gulf Coast to Fort Worth and on to Graham in North Texas.

TESCO has formed a new subsidiary, Old Ocean Fuel Co., Inc., to build the line. And Old Ocean Fuel already has set up a construction office at Waco, Tex., about midway along the route of the line, to direct route surveying and subsequent work.

J. B. Thomas, president of TESCO and of Old Ocean Fuel, told the Journal last week that the engineering contract has been let to Ford, Bacon & Davis and that route surveying is already under way.

Thomas said acquisition of right-of-way would begin later this year, actual pipe laying in early spring next year. The line is slated to go into operation by the end of 1960. It will supply fuel for three existing generating stations in the Fort Worth area and another big plant now building at Graham in Young County.

TESCO has signed contracts with Pan American Petroleum Corp., Magnolia Petroleum Co., and a dozen other producers to buy the Old Ocean gas. Initially, it will purchase 100,000,000 cu. ft. daily, with deliveries to step up later to at least 150,000,000.

**Operating by 1960** . . . Thomas declined to give capacity of the line or the price which his firm will pay for the gas. Informed sources, however, peg the initial price at 21.5 cents per M.c.f., escalating 2 cents every 4 years to a top of 29.5 cents. The sale will be in intrastate commerce. And prices will not be subject to control or revision by the Federal Power Commission.

The TESCO president, however, admitted under further questioning that prices previously published in the Journal (OGJ, Apr. 13, Newsletter) were "in the ball park." The 21.5-cent price with the 2-cent escalation was the price published earlier.

The projected new pipeline will extend 360 miles from Old Ocean in Brazoria County to Graham. Exact size of the 290-mile main trunk to Fort Worth has not yet been definitely fixed. It will be either 22 or 24-in. The 70-mile lateral from Fort Worth to Graham will be 16-in.

The construction timetable for the TESCO line is one almost certain to be met. The line must be in operation by late 1960. TESCO'S present gas-supply contracts expire in December of that year.

Thomas also declined to comment on why TESCO is building its own line rather than buying the gas from one or more of the large gas pipelines operating in the state. "That," he said, "is a good question for you to ask, but a poor one for me to answer."

# Tennessee Gas's Expansion Will Feed Midwestern's Line

TENNESSEE GAS Transmission Co. will spend $69 million this year on new construction to service the projected Tennessee-to-Chicago pipeline and fulfill commitments to other customers of the company.

The new construction, together with completion of construction started in 1958, will raise Tennessee Gas's pipeline capacity by 20%.

Present capacity is about 2 billion cubic feet on average days and 2.4 billion on peak days. The new capacity will be 2.5 billion average and 2.9 billion peak.

A large part of construction will be for the compressor system, the biggest such program in the company's history. It will add 113,100 hp. to the present 641,300 hp., an increase of about 18%. Four new compressor stations and enlargement of 13 existing stations are included.

Tennessee Gas has let contracts on 201 miles of new line in Tennessee, Kentucky, and West Virginia. These consist of 173 miles of 30-in. and 28 miles of 26-in. lines parallel to the existing system.

The company later will announce construction plans for the $50.8-million Midwestern line from Portland, Tenn., to Joliet, Ill. The parent company must furnish the gas for this line through its existing system. The new Midwestern line will have a capacity of about 200 million cubic feet of gas daily at the beginning. Eventually this will be raised to 360 million.

**SAND AND WATER** jet into the air as oil men got their first look in Midland last week at Western Co.'s new Hydra-Perf method of perforating. The method uses erosion to make perforation.

# New Perforating Method Developed

• Western Co. uses erosion in a fast, effective perforating technique that was shown to oil men for the first time last week. Company claims this new method gives an operator more control of perforations.

WESTERN Co. last week unveiled a revolutionary new erosion method of perforating wells which it thinks may eventually put conventional jet and bullet perforating in the same class with the dodo bird.

The new technique, which western has tentatively named Hydra-Perf, uses a directed stream of abrasive containing fluid to cut holes through casing cement and pay formation.

It is fast and powerful. Average time consumed in perforating, Western says, is only about 3 minutes. And the resulting perforations into the formation are measured in feet rather than inches.

The tool which makes this possible is a heavy-steel tube made up to the business end of a conventional tubing string and resembling a small casing shoe or drill collar. Ports in the tool are fitted with hard-steel plugs, each with a small, precision bored orifice. In operation, abrasive fluid is pumped down the tubing under 2,000 to 3,000 psi. The fluid makes a right angle turn in the tool to go out the ports and perform its cutting work.

Surface equipment needed is a conventional frac pump with 600 hp. or more and a blender for the sand and fluid—the same basic equipment as is used for a frac job.

Fluid and sand needs, however, are small. For a normal job, they would run only about 25 to 30 bbl. of fluid and a few pounds of sand per gallon. Either oil or water is suitable as the fluid.

**Process demonstrated** . . . Operators got their first look at the tool and what it can do last week in demonstrations at Midland.

For the show, Western buried underground a 50-gal. drum. Centered in the drum and surrounded by about 9 in. of cement was a section of J-55, 17-lb. 5½-in. casing.

In 3½ minutes from start of the perforating operation, the abrasive stream of water and 20/40 frac sand bored through the casing, the cement, the drum, and emerged from the ground after penetrating 20-25 ft. of top soil. The holes on the inside of the casing were ½-in. in diameter and perfectly round with no burring.

**Its advantages** . . . Western claims these advantages for its unique new perforating method:

. . . **Penetration depth** can be controlled to give operator any reasonable desired depth. The longer the abrasive fluid is pumped, the deeper the hole is gouged.

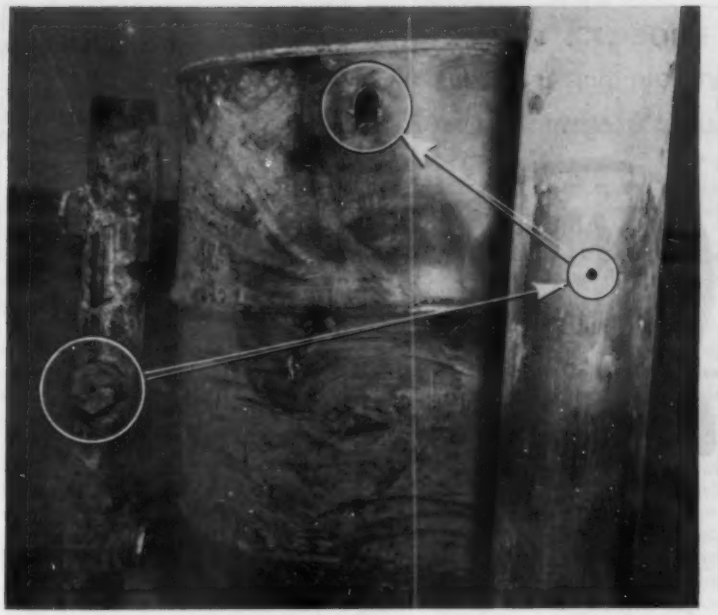
. . . **Hole size** also can be controlled. Normal hole size, Western says, is about ½ in., but this can be increased or decreased. Enlarging the hole size, however, reduces to some extent the depth of penetration.

. . . **No cement shattering** results since there is no explosive force.

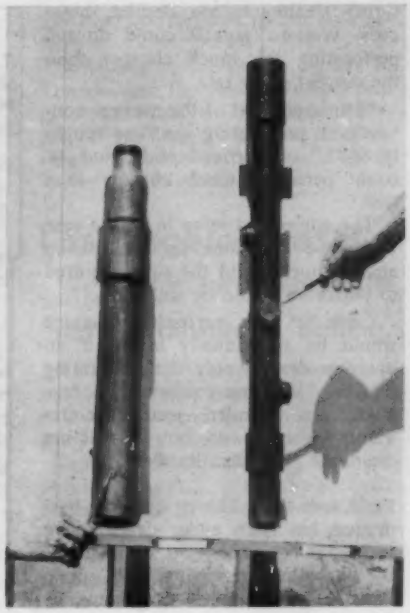
. . . **Testing can follow** quickly after perforating of pay zones in that there is no need to pull and rerun tubing or drill pipe.

. . . **Smooth holes** in casing make for more effective use of ball sealers if fracturing follows perforating, also facilitates running tools down hole.

. . . **Complete service job** is possible on just the one setup. This includes perforating and stimulating the well



**IT TOOK** only 3½ minutes for jet stream to come from new tool, left, make a ½-in. hole in 5½-in. J-55 casing, right, and penetrate 8 in. of cement and blast out of a drum in which the casing was cemented. The casing was penetrated in 30 to 40 seconds.



**TWO TYPES** of tools are planned. One, left, will make six holes on the same plane. The other, right, will make two holes per foot on 90° phasing.

by either acidizing or fracturing. This is provided the frac job is conducted through the casing-tubing annulus. This method is expected to be adapted later on to follow up fracturing of any kind on the same equipment set up.

. . . **Quick production** can be attained in areas where it is known wells come in natural. Operator could run a packer beforehand, perforate, set down on packer, and place well on production. The perforating tool could be left on the string to operate as a down hole choke in such a case, or possibly sheared off and left on bottom.

The technique, Western thinks, has many ramifications and possibilities—many of them not yet investigated.

**How it works . . .** The new perforating method digs hole through steel, concrete, and rock much like a garden hose digs a hole in the top soil when the nozzle is adjusted for a hard stream. The difference is that, wherein the garden hose is using perhaps 30 psi. pressure, the new perforating tool employs 2,000 to 3,000 psi. of differential pressure across the orifices. Then, the latter has the erosive sand thrown in to boot.

Size of the holes and the depth of penetration for a given formation and a given type of casing are a combined function of the size of the orifices in the tool, the amount of differential pressure across the orifices, and the length of time the fluid is pumped.

The tool can be positioned currently in any one of three ways. Hole bottom can be touched and the tool backed off bottom the proper distance in cases where good solid well information is available. It also can be positioned with a tubing gamma-ray survey to locate tubing collars. Or the tubing can be strapped.

Centralizers are used to hold the tool in the center of the casing. The tubing is loaded prior to perforating. And the casing valve is kept open at the surface. There is no pressure strain which would require high-strength tubing.

Some sand is left in the bottom of the hole as a result of the deep perforations. It can either be circulated to the surface or left in the hole and used in a follow up frac job if one is planned.

**Cuts 8 holes . . .** Western plans to manufacture the tools for use in anything from 2½ in. "casing" on up. It feels that the process will prove especially desirable for slim holes where conventional means of perforating are hampered by size limitations on charges.

The tools are available in two models. One of them will cut a maximum of 8 holes simultaneously; the other 6 holes.

The 8-hole tool employs a 2-hole per foot pattern, with the holes phased 90°. This creates a spiral perforating pattern, with a complete spiral taking up for perforations and 2 ft. of hole.

The 6-hole tool employs the so-called fracture initiation technique wherein all size holes are on the same plane—three of them in one direction, the other three in the opposite direction.

If more than the 8 or 6 perforations are desired, the tubing is raised or lowered the desired distance and the process repeated.

The limiting factor on the number of holes that can be dug at one time is that proper differential pressure must be retained across the orifices. Eight perforations currently is the maximum wherein this pressure can be maintained.

**The economics . . .** Western says the process now is available on a limited or developmental basis. But the company intends to be selective in choosing holes "for a while yet."

Though the process has proved highly effective in all cases used in the field, Western says it isn't yet in a position where it can guarantee an operator the exact size and depth of perforations he desires for a certain pay formation.

This will come following further testing. Likewise, costs of the service have not been pinned down, pending completion of cost studies by the company.

Where both perforating and frac-

turing treatments are desired, however, Western says it could do the perforating job much cheaper than the current going rate.

"Minimum cost of the average conventional perforating job runs roughly $425," one official said, "and we could perforate much cheaper than that."

The equipment setup in such a case would be the same for perforating and fracturing and the time required to perforate would be small.

Costs of the perforating service would be substantially higher if an operator desired only the perforating service. The same equipment, a frac truck and blender, would be required whether or not a fracture treatment were also involved.

**Field tests . . .** The new Hydra-Perf process has been under development for about 3 years.

Perforating employing both operations have been run for operators in the past few weeks.

In one perforating job, the company used 14 bbl. of lease crude and 2 lb. of sand per gal. to perforate a West Texas well at 4,380 ft. The operation lasted 3 minutes. Flowing production resulted from the previously unperforated pipe, and the well came in natural.

Potential on the well has not yet been taken. But the production, Western says, proves that it made holes in the pipe, cement, and formation.

Results were the same on a recent operation in a 7,500-ft. well.

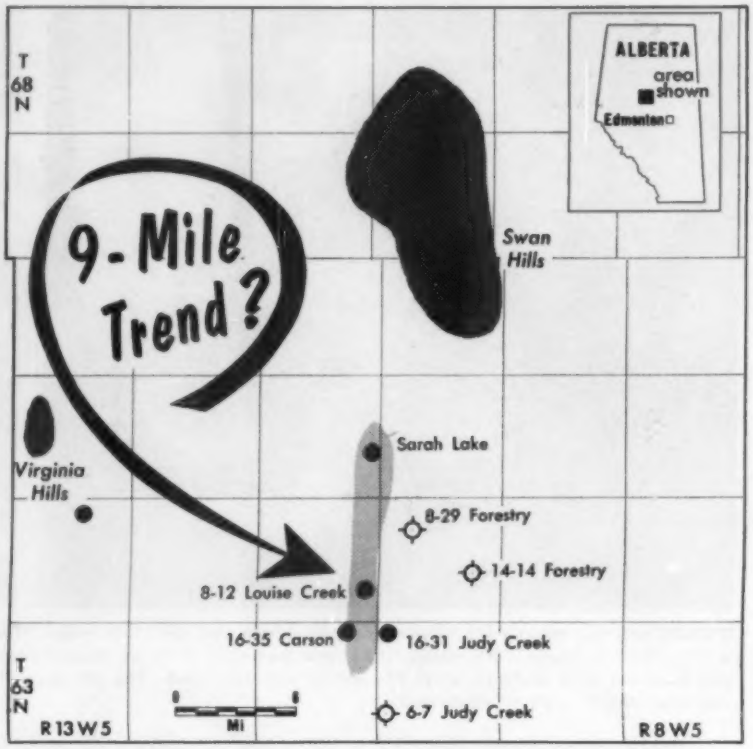
## Armour Buys Ammonia Plant

ARMOUR & CO. has purchased the 240-ton ammonia plant of the Mississippi River Fuel Corp. at Festus, Mo., on the Mississippi River south of St. Louis.

Armour will take over about June 30. The plant was placed on stream in 1955 and charged natural gas supplied by the company's pipeline system from the Gulf Coast. It wholesales natural gas for St. Louis consumption.

The sale will not affect the Mississippi River Fuel's gas transmission, oil exploration, mud sales, and related operations. William G. Marbury, St. Louis, board chairman, said the Festus plant is his company's only ammonia operation and the company does not plan to re-enter the field.

Armour has formed Armour Agricultural Chemical Co., Atlanta, Ga., to handle nitrogen, ammonia, fertilizer and phosphate operations. This will be Armour's first anhydrous ammonia plant.




# Strikes Spice Alberta Sale

**. . . and point to possible 9-mile trend of production. Two finds reported, but Imperial isn't talking about them.**

A 9-MILE production trend is indicated in the Judy Creek area of Alberta with reports of two discoveries —both tight holes.

The strikes, by Imperial Oil, Ltd., point to a north and south trend from Imperial's discovery well, 16-31 Judy Creek, on the south to the Sarah Lake find on the north. The area is 15 miles south of big Swan Hills field.

The new strikes—Imperial 8-12 Louise Creek and Imperial 16-35 Carson—form a triangle with the Judy Creek discovery well. Three other tests in the area, each 5 miles from the discovery well, reportedly are dry holes. They are 8-29 Forestry, 14-14 Forestry, and 6-7 Judy Creek.

Imperial also is believed to have staked four new locations, none more than 1¼ mile from the discoveries. Exact locations have not been released.

Imperial is reported to have dropped from the scout check to keep from disclosing information on the possible major oil find.

**Why the silence . . .** Operators may be playing it close to their chests because of lease sale set for July 23.

Included in the sale are seven half-section tracts in the Judy Creek area, all near the indicated oil finds. Also, 10 tracts are up for bid in Swan Hills field. A total of 111,044 acres will be up for cash bonus bids.

Imperial obtained its current Judy Creek holdings at the 1953 Crown sale for a cash bonus of $322,560. That was 4 years before Home Oil et al. tapped Swan Hills field.

The Judy Creek tracts in the July sale are expected to bring several million dollars.

## California Tax Killed

CALIFORNIA Governor Edmund (Pat) Brown's efforts to impose a 2% severance tax on oil and gas production died last week amidst a flurry of last minute parliamentary wrangling in the California Assembly.

The sequence leading up to its demise went like this:

After it appeared that the bill wouldn't even get out of the revenue and taxation committee, proponents gained a momentary victory by getting a majority vote on a motion to switch

the bill to the more sympathetic ways and means committee.

The next day, however, opponents of the bill pushed through a favorable vote on a proposal to reconsider the earlier move to switch committees. Then when it came time to vote on which committee to send it back to, the assembly voted instead to table the whole thing. At that point, the bill's author, Jesse Unruh (D-Los Angeles) said he was dropping the fight.

At one critical 6-hour period in the haggling, chartered planes were sent touring the state rounding up absent assemblymen who had indicated previously they would vote against the severance tax. The motion to table the bill, which killed it, squeaked through by a 37-35 vote.

## Anchorage Gas Bid Made

A GAS distribution firm formed mainly by Houston businessmen hopes to obtain a gas franchise to serve the city of Anchorage, Alaska.

Anchorage Gas Corp. has incorporated in Alaska with Robert B. Baldwin, Houston, as president. The Anchorage city council has approved the franchise, and Anchorage citizens will vote on the issue late this summer.

Officers of Anchorage Gas, in addition to Baldwin, are Horace B. Webb, Frank Chilson, and D. N. Barrow, all vice presidents; William C. Smith, Jr., treasurer; Seaborn Eastland, Jr., secretary, and Paul F. Robison, general counsel.

## Monterey Expands

### . . . by forming pipeline firm on intrastate basis.

ANOTHER producing company is going into the gas-pipeline business to supply intrastate markets which are outside federal jurisdiction.

Monterey Oil Co. has formed Monterey Pipeline Co. to supply industries along the Mississippi River from Darrow Dome, Lake Boeuf, and other South Louisiana fields. Its first project is a $2,500,000, 37½-mile 8 and 14-in. system, now under way, to supply 25,000 M.c.f. daily to Kaiser Aluminum & Chemical Corp. at Gramercy, La., starting January 1.

Monterey will be integrated with the 85-mile line of Sugar Bowl Pipeline Co., Inc., which will operate both systems. Monterey is now supplying through Sugar Bowl Pipeline more than 5,000 M.c.f. daily to Wyandotte Chemicals Corp. at Geismar, La.

The new company will supplement Sugar Bowl peak requirements with 10,000 M.c.f. daily during the fall sugar cane grinding season.

Howard C. Pyle, president of Monterey Oil and Monterey Pipeline, said the project would produce important revenues for his company. The fields involved produce 30 to 50 bbl. of condensate per million cubic feet of gas.

Gulf Interstate Co., Houston, is consulting engineer for Monterey and Houston Contracting Co. is building the line, due for completion in September.

Monterey is one of the owners of Transwestern Pipeline Co., whose proposal to build a 1,809-mile $191-million gas line from Texas to California is now before the Federal Power Commission.

## Los Angeles Tests

### . . . on film lot and in Watts revive downtown drilling.

THE RIGGING up of one wildcat and city approval for another reversed a downward trend in drilling in metropolitan Los Angeles last week.

Continental Oil Co. was granted permission to drill an 8,000-10,000 ft. wildcat on the Metro-Goldwyn-Mayer film lot in Culver City. Operations will probably start within 2 weeks.

Western Gulf Oil Co. is rigging up for a 12,000-ft. wildcat test in the town of Watts, in southeast Los Angeles.

The Continental site is about 1 mile north of the Inglewood oil field and about the same distance south of the highly successful operations at the Rancho and Hillcrest golf courses and 20th Century Fox studios.

The structure to be drilled is considered separate from the other two fields, however. Continental has 800 acres under lease, including the MGM lot and the old RKO lot nearby. The RKO lot is now owned by Desilu Productions.

## the JOURNAL said. . . . .

### 50 years ago

June 20, 1909

The largest single shipment of pipe ever made by water from the Pittsburgh district moves down the Ohio and Mississippi rivers to Baton Rouge and New Orleans. Loaded on a barge tow at National Tube Co.'s McKeesport plant, the pipe is enough to fill 100 freight cars, or four ordinary freight trains.

Once more the air is thick with rumors Prairie Oil & Gas Co. will move its main offices from Independence, Kans., to Tulsa. Company agents are reported trying to buy valuable Tulsa real estate for a new building.

Louisiana State Commission for Conservation demands that governor take steps to close three wild gas wells in booming Caddo field, north of Shreveport, and prevent blowouts in the future. It recommends appointment of a state agent to supervise drilling of wells.

New Texas City Refining Co. refinery at Texas City, across the bay from Galveston, starts operation. It is running 2,000 bbl. of crude oil daily shipped by tank car from Chelsea, Okla.

### 25 years ago

June 14, 1934

General Petroleum Corp. prepares to test oil and gas showings in its deep Berry well in South Belridge field, Kern County, California. Already the world's deepest test, the well, at 11,377 ft., may become the world's deepest producer.

George W. Strake, Houston independent and discoverer of the large Conroe field joins the swelling group of oil men taking to the air for getting around their operations.

Successful experimental use of air-repressuring in old shallow sands in Wanango area, Pennsylvania, watched by oil operators as means of boosting oil recoveries in other fields.

Fifty strings of tools running in Allentown district of Allegany County, New York, in East's most active development program.

Hottest lease play in many years by new oil discovery by Wood & Young at their New Birmingham wildcat southwest of Rusk, in Cherokee County, East Texas.

### 10 years ago

June 16, 1949

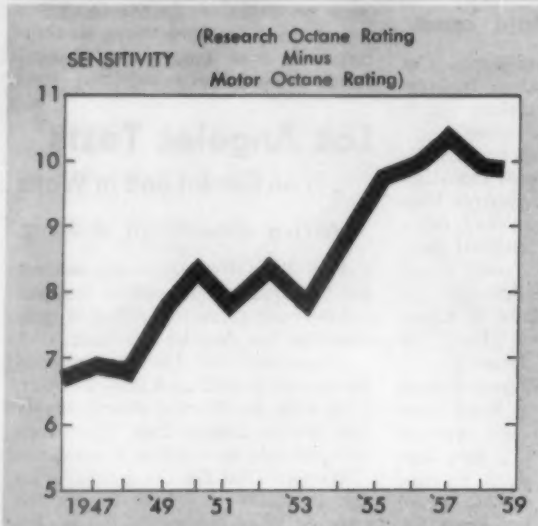
Ohio Oil Co. completes its 1 Egging wildcat near Gurley, north of Sidney, Nebr., as first oil producer in western Nebraska and on eastern side of Denver-Julesburg basin. Intense leasing play gets under way as new discovery well goes on pump from 4,400-ft. sand believed to be the Muddy.

Pacific Western Oil Corp. acquires Dutch stock interests, totaling 128,000 shares, in Tide Water Associated Oil Co. Purchase increases holdings of J. Paul Getty interests in Tide Water to 35% of total outstanding.

Superior Oil Co.'s Pacific Creek wildcat in Sublette County, Wyoming, becomes first well to reach depth of 20,000 ft. Already below the previous world's depth record of 17,823 ft., it is drilling ahead at 20,420 ft.

Plans for pressure maintenance program for huge multiple-pay Old Ocean field in Brazoria and Matagorda counties on the Texas Gulf Coast revealed by J. S. Abercrombie Co., field operator.

## Trend in Premium Gasoline Sensitivity




The sensitivity factor of premium has been increasing steadily since World War II. The average premium sensitivity in 1946 was just under 7. By 1957 sensitivity had increased to better than 10.5.

Last year, it dropped back to 10. It has been unchanged so far in 1959. It is uncertain whether last year's drop was the beginning of a downward trend or merely the end of a rising trend.

But it is almost certain that as refiners move to meet the part-throttle knock problem, the sensitivity of premium will go down. It is also probable that the drop in premium sensitivity will be offset by an increase in the sensitivity of regular.

# Refiners Take On Sensitivity Problem

• More sensitive gasolines have led to more part-throttle knock in the later model, maximum economy cars. This means refiners are confronted with a situation which will require a complex and expensive solution.

DETROIT'S pressure for more economy in cars is causing refiners to take a closer look at gasoline sensitivity—the difference between research and motor octane ratings.

Part-throttle knock has focused refiners' attention on sensitivity, which now varies widely among the different gasoline brands. Less variance is expected in the future, however, as refiners take steps to correct the situation.

The current U. S. average sensitivity for premium gasoline is 10.1—the difference between the national average of 99.1 research octane and the 89.0 motor octane rating.

Regular is much less sensitive than premium. The national weighted average for regular grade gasoline is 91.7 research and 84.4 motor. This gives regular an average sensitivity of 7.3.

**The problem . . .** Increasing occurrence of part-throttle knock in the later model cars has accented the need for a solution.

During the first 10 years following World War II, knocking was associated mainly with full or almost full-throttle operation. But as gasolines became more sensitive, part-throttle knock became a problem.

It began to gain attention when it occurred in some of the 1956 and 1957 models. It became more common last year and is again prevalent in 1959 models.

Part-throttle knock is part of the price being paid when auto manufacturers seek maximum economy with today's sensitive gasolines. In the move to get maximum economy from their engines, they have increased compression ratio and have gone in for lean mixtures and a high spark advance in the part-throttle range.

These steps have imposed more severe demands on motor fuel at less than full-throttle operation. These demands are most acute during slow accelerations at moderate speeds.

Since the average motorist accelerates more frequently in the part-throttle range, the potential incidence of part-throttle knock is much greater than that of full-throttle knock. Therefore, cars liable to part-throttle knock are more likely to cause annoyance than cars which knock only at full-throttle.

Actually, the engine operating conditions are more severe under part-throttle conditions than full-throttle conditions. This depreciates the value of a sensitive fuel considerably. Since the motor method of octane ratings more truly evaluates the needs of "severe" engines, this situation has tended to bring motor octanes to the fore.

**The solution . . .** Knocking at full-throttle operation is no less a problem than it was before. Therefore, refiners are faced with the problem of compromising between research octanes for full-throttle, low-speed knock, and motor octanes for controlling both full-throttle, high-speed knock and part-throttle knock.

Just how to go about this is a peculiar problem for each individual refiner. It can be related to the type of crude he charges, the kinds of processes he employs and the severity at which he operates them. The solution is not simple.

There are a number of routes that

## Gasoline Sensitivity—A Real Variable for Refiners

| Brand | No. of Samples | PREMIUM High | Low | Brand Average | U. S. Average | Difference | REGULAR High | Low | Brand Average | U. S. Average | Difference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 8 | 11.7 | 8.9 | 10.9 | 10.1 | + .8 | 7.5 | 4.9 | 6.7 | 7.3 | − .6 |
| B | 13 | 10.2 | 4.6 | 8.2 | 10.1 | −1.9 | 7.0 | 2.5 | 5.0 | 7.3 | −2.3 |
| C | 8 | 11.5 | 9.2 | 10.6 | 10.1 | + .5 | 8.7 | 5.5 | 7.1 | 7.3 | − .2 |
| D | 44 | 12.7 | 8.6 | 9.6 | 10.1 | − .5 | 9.8 | 2.8 | 7.4 | 7.3 | + .1 |
| E | 6 | 10.8 | 8.6 | 9.3 | 10.1 | − .9 | ... | ... | ... | ... | .... |
| F | 9 | 12.1 | 9.3 | 10.9 | 10.1 | + .8 | 9.7 | 5.1 | 7.8 | 7.3 | + .5 |
| G | 25 | 11.6 | 7.5 | 10.4 | 10.1 | + .3 | 9.1 | 4.5 | 6.8 | 7.3 | − .5 |
| H | 15 | 13.4 | 6.4 | 11.7 | 10.1 | +1.6 | 11.1 | 5.6 | 9.0 | 7.3 | +1.7 |
| I | 15 | 12.8 | 8.3 | 10.7 | 10.1 | + .6 | 10.4 | 6.5 | 7.7 | 7.3 | + .4 |
| J | 7 | 11.8 | 10.4 | 11.4 | 10.1 | +1.3 | 8.9 | 5.2 | 7.2 | 7.3 | − .1 |
| K | 8 | 9.7 | 8.5 | 9.2 | 10.1 | − .9 | 9.0 | 7.1 | 8.0 | 7.3 | + .7 |
| L | 16 | 12.1 | 8.6 | 10.7 | 10.1 | + .6 | 9.3 | 4.9 | 6.7 | 7.3 | − .6 |
| M | 31 | 11.3 | 8.5 | 10.2 | 10.1 | + .1 | 10.3 | 2.7 | 7.7 | 7.3 | + .4 |
| N | 23 | 10.2 | 6.7 | 8.4 | 10.1 | −1.7 | 9.8 | 4.6 | 7.4 | 7.3 | + .1 |
| O | 6 | 11.4 | 10.3 | 10.9 | 10.1 | + .9 | 8.9 | 6.8 | 7.7 | 7.3 | + .4 |
| P | 14 | 11.5 | 9.7 | 10.5 | 10.1 | + .5 | 9.8 | 4.6 | 7.6 | 7.3 | + .3 |
| Q | 15 | 9.3 | 8.2 | 8.8 | 10.1 | −1.3 | 9.1 | 7.8 | 8.6 | 7.3 | +1.3 |
| R | 10 | 11.2 | 9.8 | 10.3 | 10.1 | + .2 | 8.1 | 4.2 | 5.9 | 7.3 | −1.4 |
| S | 8 | 10.5 | 7.5 | 9.5 | 10.1 | − .6 | 6.1 | 2.8 | 4.9 | 7.3 | −2.4 |
| T | 35 | 11.8 | 8.8 | 10.3 | 10.1 | + .2 | 9.5 | 3.4 | 7.2 | 7.3 | − .1 |
| U | 17 | 12.3 | 6.2 | 9.8 | 10.1 | − .3 | 8.8 | 4.2 | 6.4 | 7.3 | − .9 |
| V | 12 | 12.8 | 11.1 | 11.9 | 10.1 | +1.8 | 9.2 | 4.5 | 6.7 | 7.3 | − .6 |
| W | 8 | 10.3 | 4.1 | 8.5 | 10.1 | −1.6 | 7.6 | 3.9 | 5.6 | 7.3 | −1.7 |
| X | 18 | 11.2 | 7.2 | 9.7 | 10.1 | − .4 | 7.5 | 3.0 | 5.5 | 7.3 | −1.8 |
| Y | 8 | 12.7 | 9.9 | 10.7 | 10.1 | + .6 | 9.7 | 4.6 | 7.3 | 7.3 | .... |

GASOLINE sensitivity is a complex problem that varies widely among U. S. refiners.

The sensitivities in this table were calculated from the Ethyl monthly survey of motor fuels for April. The brand averages are simple, not weighted. The brands included are those that were sampled in more than five of the 57 cities covered by the survey. Thus, they represent a large portion of all gasoline sold in the U. S.

The ideal sensitivity for either premium or regular cannot be clearly defined. A rule-of-thumb followed by refiners is comparison with the national average. If the sensitivity of your premium is above 10.1, you are below the average. If it's below that figure, you're above the U. S. average. The same principle applies to regular with the breaking point at 7.3.

The lower the sensitivity of a gasoline, consonant with its ability to meet Research octane requirements, the more effective it will be in satisfying both part and full-throttle knock.

Brand "B" is a good example. Its 13 samples of premium average 99.4 RON and 91.1 Motor octane numbers, both well above the national averages. Its average sensitivity of 8.2 is well under the national average. Thus, this premium would go a long way toward satisfying both part and full-throttle knock.

The refiner of Brand "V" has a different situation. His premium sensitivity is too high, but his regular sensitivity is better than average. It would appear desirable to trade some of the more sensitive components of this premium for some of the highest-octane paraffins of the regular. This would help even out the sensitivities of the two grades if component flexibility would permit such a trade.

can be followed. All mean higher costs or some other sacrifice.

One possible route is to alter hydrocarbon content. It could mean upgrading certain components of less sensitive regular and trading them for some of the more sensitive hydrocarbons of the premium. This would make the regular fuel more sensitive. But unless there was an accompanying increase in Research octane, the lower motor octane would severely handicap commercial engines which depend on motor octane numbers for knock-free performance.

Tests have shown that the substitution of aromatics for olefins does improve motor octanes and reduce sensitivity. And there has been a trend to reduce olefin content in recent years. This doesn't get a refiner ahead very fast, however, as aromatics are also quite sensitive.

Average olefin content of premium has dropped from 24.1% by volume in 1955 to 17.5% in 1958. Despite this drop, the olefin content of premium is still higher than that of regular or superpremium.

Premium's saturate content also is lower than the other grades. This makes it appear that, where possible, some switching could be done to benefit premium.

Another possible route would be to increase the use of alkylate in motor fuel. This is probably the best, but certainly not the cheapest, route. It's good because alklylate has an extremely low sensitivity. It is almost equally effective in increasing research and motor octanes.

More and more alkylate is becoming available, so its use in motor fuel is growing. Last year there was a 20% increase in alkylation capacity in the U. S. And, despite the general slowdown in refinery construction, another increase is expected this year. This supply will be further augmented as jet fuel replaces aviation gasoline. The problem of sensitivity will be considerably lessened for those whose supply of alkylate is on the upswing.

Another route would be the use of isomerization to permit inclusion of more highly insensitive isopentanes and isohexanes in premium. There are a few isomerization units in operation, but refiners generally consider it quite expensive unless they have a unique processing situation.

A fourth route would be to increase

lead content which permits maximum paraffins in gasoline. Refiners had been using less and less TEL until recently. It looks now like this unique situation is correcting itself. The average TEL content of premium in May was 2.59 cc. per gallon. This is up from a February low of 2.43 and last May's 2.49. Use of lead in regular jumped to 1.82 cc. per gallon in May, a steady increase from February's low of 1.48.

While the part-throttle knock problem has given rise to a number of uncertainties, one thing is sure: It's a problem the industry will solve. It has solved other such problems in the past by tailor-making fuels. Solution of this problem will bring a gasoline just a bit closer to being a 100% tailor-made product.

## Purdy Recovery Plan Pushed

A SECONDARY-RECOVERY project and unitization program involving 568 wells on 33,900 acres is planned in Northeast Purdy field in Garvin County, Oklahoma, by Cities Service Oil Co. There are 232 dual completions involved.

If 1,500 royalty interests, 300 working interests, and the Oklahoma Corporation Commission authorize it, the project can be started by January 1960.

One unit involves 22,400 acres with production from the Hart formation and two other units cover 10,000 and 2,500 acres with Springer production. The field was discovered in October 1951. Present production from approximately 9,000 ft. totals 7,000 bbl. daily from the Springer and 5,000 bbl. daily from the Hart.

The type of recovery process to be used has not yet been determined.

# Court Voids Dormant Gas Tax

### . . . in Louisiana, so legislature may consider renewal of 2.3 cents M.c.f. severance tax. State will appeal.

A LOUISIANA court ruling has knocked out a state gas gathering tax which had been suspended. The ruling sets the stage for a legislative attempt next year to renew a severance tax which had been substituted last year for the gathering tax.

The legal issue must still travel the appeal route to the Louisiana Supreme Court and probably won't be decided prior to expiration of the severance tax in August 1960.

Here is the history of Louisiana's effort to collect more revenue from the natural gas industry.

The legislature in 1954 rewrote its gathering tax law to get around a U. S. Supreme Court decision which had held unconstitutional a similar gathering tax in Texas. The tax was 2 cents per thousand cubic feet and was levied against the pipeliner or processor after the gas left the wellhead.

Fearful that the tax would be held illegal, thus knocking out some $40 million to $50 million in annual revenue, the administration of Gov. Earl Long pushed through a bill last November which suspended the tax until August 1960.

**Gas soon tax free . . .** In its place, the legislature increased the severance tax from 0.3 cent per thousand cubic feet to 2.3 cents. A severance tax is levied against the producer at the wellhead.

The legislature provided that the severance tax would expire in August 1960, the same date that the suspension of the gathering tax was to be lifted.

The ruling of District Judge Coleman Lindsey at Baton Rouge last week means that in August 1960 there will be no major tax at all on natural gas, and the state will lose the revenue.

Louisiana will elect a new legislature late this year. The members will take office in May 1960 to deal with the problem.

Budget officers of Governor Long, who currently is in a psychiatric clinic in Galveston, Tex., were urging last week a reenactment of the gas severance tax. They believe the legal issue will not be settled on appeal by the August 1960 expiration date.

**State to appeal . . .** Judge Lindsey's ruling involved three lawsuits filed by Humble Oil & Refining Co., Southern Natural Gas Co., and Belaire Oil Co., and Calcasieu Paper Co. The companies contended the Louisiana constitution forbids taxes on mineral leases other than severance taxes.

Judge Lindsey agreed with this argument and said there is "no such thing as a gas gathering tax."

Robert Roland, state revenue collector and defendant in the lawsuits, said he will appeal the decision to the state Supreme Court this week.

# *INDUSTRY BRIEFS . . .*

**The next meeting** of the World Petroleum Congress, its sixth, will be held in the Federal Republic of Germany and Sir Stephen Gibson of Great Britain will serve as chairman. Meetings usually are held every 4 years but the date and convention city will be selected later. Sir Stephen is a former general fields manager for the old Anglo-Iranian Oil Co. in Iran and a former managing director of Iraq Petroleum Co. He is a member of Britain's Institute of Petroleum Council.

**In a $4,853,000 deal,** Christiana Oil Corp., Beverly Hills, Calif., last week sold its 40% interest in the 7,800-acre Diamond Bar Ranch in Los Angeles County and producing properties in the East Coyote and Long Beach oil fields to Capital Co. Capital, a wholly-owned subsidiary of Transamerica Corp., owned the other 60% interest in the properties involved.

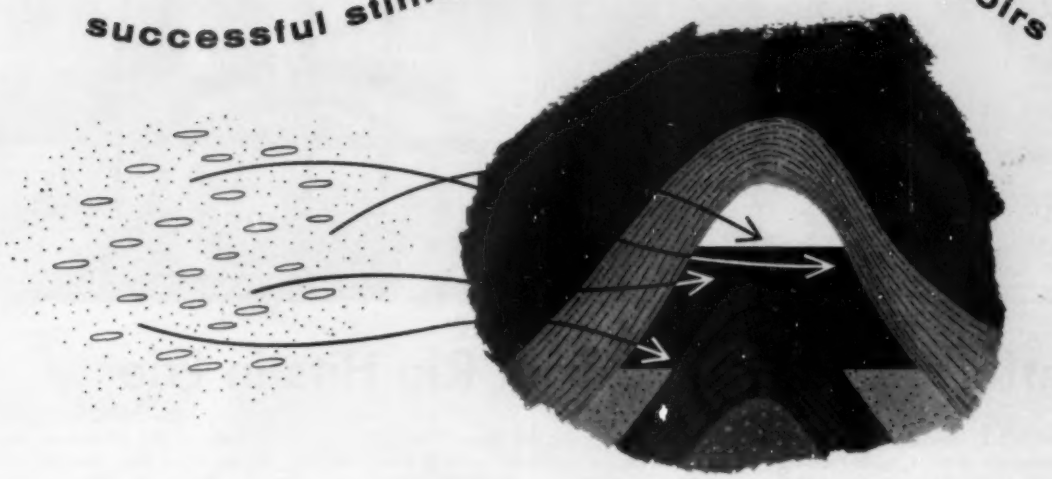
**Work will begin in July** on a 1,400-ft. supertanker terminal, the Pacific Coast's largest, at Long Beach. It is being built by the city for lease to Richfield Oil Corp. Richfield will install Chiksan unloading arms to handle 800,000-bbl. tankers, build a 24-in. line from dock to a tank farm 1 mile away, and another 14-in. return line for bunkering tankers. The harbor channel will be dredged to 55 ft.

**A 320-acre lease** in the Harper field of Ector County, Texas, with 32 producing oil wells, has been purchased by Stekoll Petroleum Corp. and Heritage Petroleum Corp., Dallas, from Ike Lovelady of Midland. Production is from the Grayburg-San Andres formation at 4,100 ft. Oil reserves are estimated at 2 million bbls., gas reserves at 7 billion cu. ft. The property will be operated jointly.

**Ambassador Oil Corp.** has acquired 51 producing oil wells in four fields in Eddy and Chaves counties of Southeastern New Mexico from R. R. Wooley, Beverly Hills, Calif. Ambassador plans to flood the properties.

# HALLIBURTON
# SANDOIL:

## successful stimulant for stubborn reservoirs



More successful fracturing treatments have been accomplished by Halliburton Sandoil than by any other fracturing process. Used to create oil drainage systems ... opening new flow channels for profitable production ... Sandoil is adaptable to individual well requirements in three important ways:

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- Emulsion problems may be controlled by Howco Hyflo and other surfactants that precede, follow or are mixed with the fracturing oil.
- Fracturing oils are selected for compatibility with the formation crude.

In addition to its flexibility, Halliburton Sandoil is economical ... It uses low-cost crude or refinery cuts and blends ... permits large volumes of fluid and sand to be used at minimum expense. And Halliburton's variable-ratio proportioners are sized to the job.

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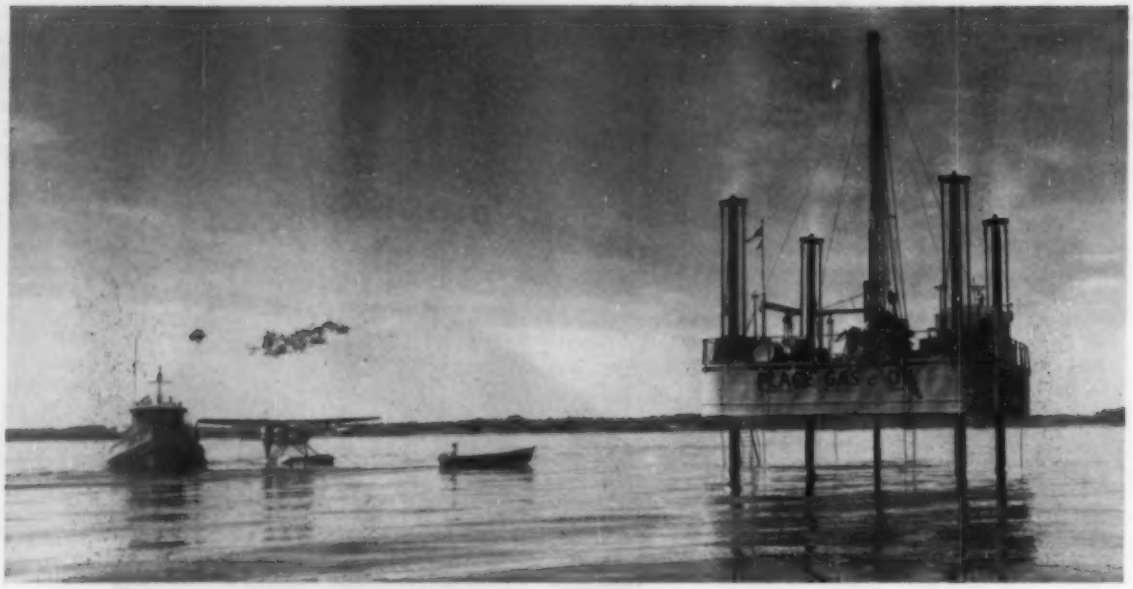


# Platform With Cable-Tool Rig Hits in Erie

A NEWLY designed mobile drilling platform—with a cable-tool rig—has paid off for Place Gas & Oil Co., Ltd., on its offshore acreage in Lake Erie.

Place used the platform, the "Mr. Cliff," to bring in the Place-Walpole No. 3 with an indicated natural flow of 925 M.c.f. of gas daily. The well is a half-mile stepout to the discovery well, Place-Walpole No. 1 in the Selkirk area of the lake. Place plans to put several of the platforms into service on its Lake Erie blocks. The platform was designed by Steltner Development & Manufacturing Co., Ltd., St. Catharines, Ont., and built by Niagara Structural Steel, Ltd.

# *PROCESSING BRIEFS . . .*

**A more efficient** and more economic process for making tetraethyl lead has been revealed by Dr. Karl Zeigler, Mulheim-Ruhr, West Germany, director of the Max Planck Institute. Zeigler says the process uses four instead of six steps, requires temperatures of 100 instead of 600° C., uses less electrical power, and consumes much less sodium and chlorine. Among a number of similar processes under development by Ethyl Corp. is one which requires half the sodium and chlorine now consumed in making TEL. This process and the Zeigler process were discussed at the World Petroleum Congress. More information is expected to be released soon on the Ethyl process.

**Union Carbide Chemicals** has doubled its capacity to produce polyether polyols at its South Charleston, W. Va., plant. The expansion resulted from increased demand for polyethers for making flexible and rigid urethane foams. In the past year, Carbide has introduced eight polyethers for use in foam manufacture.

**Continental Oil** has completed the purchase of Coastal Oil Co., an eastern fuel oil marketing company with headquarters in New York. Coastal accepted a stock exchange offer under which Continental is issuing 100,000 shares of stock for all of Coastal's capital stock (OGJ, May 11, p. 71).

**Tennessee Gas** Transmission has acquired a marine terminal for refined products at Lynn Haven, Fla. Independent Oil Co., Panama City, Fla., sold the terminal to TGT along with a 16,000-bbl. capacity barge for transporting refined products. The terminal has 30,000 bbl. of storage capacity. Bay Petroleum Co., a division of TGT, will operate the terminal.

**The first small-size** commercial Penex unit, licensed by Universal Oil Products Co., has been placed in operation by the South Hampton refinery at Silsbee, Tex. The 255-bbl. unit is converting low octane normal pentane into isopentane for use as a blending component.

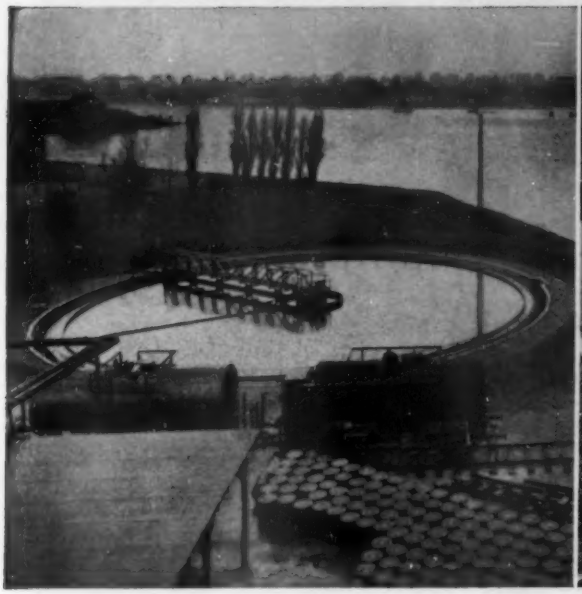
**Alberta's first LPG** underground storage project has been completed at Hughenden field, about 125 miles southeast of Edmonton. The new facilities for storing propane in salt formations were developed by Alberta Underground Storage Co., owned by Canadian Hydrocarbons, British American, and Goliad Corp. Plans called for initial capacity of 75,000 bbl., with ultimate capacity of more than 1,000,000 bbl. (OGJ, Nov. 24, 1958, p. 53).

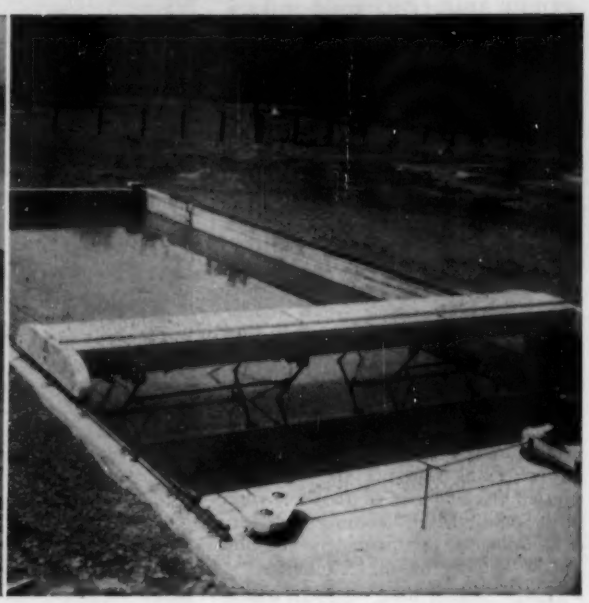
## *Also for Refiners . . .*

**IN THE NEWS:** Import volume will rise in second half because a 6% cut in Districts 1-4 is more than offset by a 15% increase west of the Rockies (p 61) . . . Refiners are taking a hard look at the new problem of sensitivity (p. 72) . . .

**PLUS THESE TECHNICAL REPORTS:** Horsepower conservation will boost profits (p. 94) . . . Sulfide scaling under hydrorefining conditions (p. 99) . . . Economics of two-stage cat cracking (p. 108) . . .

round square rectangular





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# Deep Prospect Is Stirring Delaware Basin

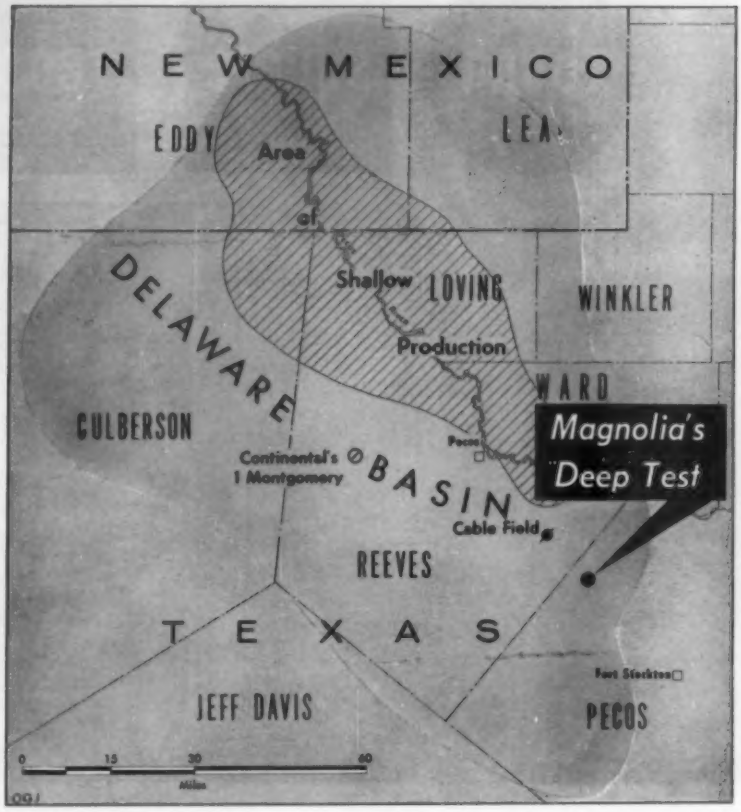
- **Magnolia test's heavy oil flows brighten outlook for area.**

DEEP DRILLING could make a comeback in the Delaware basin following heavy oil flows in a remote wildcat in western Pecos County, Texas.

The test, Magnolia Petroleum Co.'s 1 Kathleen J. Moore, is carefully coring its way ahead following the oil flows from 5 ft. of Wolfcamp pay. The well, 30 miles northwest of Fort Stockton in the southeastern portion of the basin, is in an area that has had only scattered testing, mostly medium-depth wells under 10,000 ft. Location is on a 640-acre lease in Section 19, Block 48, Township 8, T&P Survey.

When the bit reached 10,890 ft., drilling with gas in place of mud, the well started heading oil. Drilling-gas pressure was shut off and operators started backing out of the hole with drill pipe. While coming out, the well unloaded approximately 200 bbl. of 38°-gravity oil in 15 minutes.

Later gages, using gas-lift equipment on pipe run to 7,800 ft., were 86 bbl. of oil in 6 hours and 175 bbl. of oil in 13 hours. Formation water, if any, was not reported.




**The Wolfcamp . . .** This series is the lowermost division of the Permian system, named for an outcrop near Wolfcamp site in the Glass Mountains of Brewster County, Texas.

The Wolfcamp is equivalent to Hueco and Abo formations in New Mexico. As a producing formation, the Wolfcamp is on both sides of the fence. In many fields of eastern Lea County, New Mexico, and in some counties of West Texas, it has been a heavy producer. In a few areas, it is a marginal pay-out zone.

Magnolia is no stranger to the formation and to the wildcat area in which it is drilling. The company drilled the discovery well at Cable (Wolfcamp) field in 1953 in Reeves County, located about 10 miles northwest of the Moore test. Here, the pool opener made a good showing for a time, flowing 139 bbl. of oil a day on completion test. Pay was the Wolfcamp at 10,080 ft. One offset test was drilled to 5,340 ft., but the pool remained a one-well development. Production during 1953 and 1954 amounted to 2,487 bbl. of oil.

**Outlook . . .** Despite the previous poor producing record of the Wolfcamp in the Delaware basin, No. 1 Moore should stimulate further exploration.

Deep work in the basin was tapered off to almost a standstill during the last year. The only other pre-Permian test for the basin at this time is Continental Oil Co.'s 1 Charlotte Montgomery, a 15,000-ft. wildcat 8 miles west of Toyah gas field in west-central Reeves County.

Meanwhile, the basin is being studded with shallow successes all along the trend running through the basin center from Pecos in Reeves County, Texas, to Carlsbad in Eddy County, New Mexico.

# *PIPELINE BRIEFS . . .*

**A contract to build** an additional 100 miles of gathering line in South Texas for Coastal States Gas Producing Co., Corpus Christi, has been awarded to O. R. Burden Construction Corp., Tulsa. Burden recently completed 100 miles of a 270-mile gathering system for Coastal between McAllen and Falfurrias. Coastal will supply gas to Texas Illinois and Transcontinental pipelines.

**Internal coating of 242 miles** of 30-in. line in New Mexico will be applied by El Paso Natural. Contract for the job has been let to H. C. Price Co. coating division.

**Some 60 miles of 20-in.** is being laid by the Pittsburgh Group Companies of the Columbia Gas System. Harford Brothers has a contract for the construction in Greene, Fayette, Somerset, and Fulton counties, Pennsylvania. Completion is due September 30. Wilkie Contracting Co. will lay 10 miles of 8-in. replacement line from Uniontown to Connellsville, Pa., and Rich & Co. is laying 4 miles of 16-in. from Ambridge to Baden, Pa.

**Five 877-hp. gas-turbine** pumping units are being installed on crude-oil gathering lines of Kuwait Oil Co., Ltd. Two units at one station will be

### Oil Accidents—Less Often, Less Severe

| Division | Frequency* | | Severity† | |
|---|---|---|---|---|
| | 1957 | 1958 | 1957 | 1958 |
| Exploration | 7.05 | 9.41 | 729 | 848 |
| Drilling | 30.95 | 28.73 | 4,642 | 3,010 |
| Production | 8.94 | 8.20 | 906 | 1,403 |
| Natural Gasoline | 5.40 | 4.02 | 384 | 585 |
| Refining | 4.71 | 5.00 | 689 | 656 |
| Pipeline (oil) | 6.03 | 6.07 | 917 | 756 |
| Pipeline (gas) | 8.96 | 9.03 | 481 | 689 |
| Marine (ocean) | 22.82 | 20.83 | 985 | 651 |
| Marine (inland) | 11.85 | 10.64 | 2,641 | 1,153 |
| Marketing (wholesale) | 5.80 | 6.35 | 475 | 426 |
| Marketing (retail) | 17.28 | 18.54 | 276 | 470 |
| Research & Eng. | 1.75 | 2.08 | 59 | 266 |
| Miscellaneous | 2.76 | 2.72 | 571 | 532 |
| **All divisions** | 7.05 | 7.00 | 712 | 704 |

*Disabling injuries per 1,000,000 hours worked. †Days lost per 1,000,000 hours worked.

# Oil's Safety Impressive

**. . . as trend through the years shows drop in number and severity of accidents. API committee due lot of credit.**

THE NATION'S oil workers are 4½ times safer on the job than at home.

And, there's less chance of a fire in a service station—handling highly inflammable gasoline—than in churches, schools restaurants, or hotels.

That's because the oil industry, which grows bigger and bigger each year, at the same time is becoming a safer place to work and less of a hazard to its neighbors.

The trend toward safety for oil began many years ago and is reflected in figures compiled on the industry's record for 1958. They show:

. . . **Oil's accident-frequency** rate last year was 7.00 per 1,000,000 hours worked, compared with 7.05 in 1957. That's a modest improvement—but it was the seventh consecutive year in which the industry cut its accident-frequency rate.

. . . **The accidents** which did occur were less severe. The severity rate, figured in days lost per 1,000,000 hours worked, dropped from 712 in 1957 to 704 during 1958.

. . . **Fire losses,** in dollars, have ranged between $5 million and $10 million annually in the industry during the last 10 years. However, that's during a time when latest available figures show oil's insurable value has jumped from about $5 billion to $13 billion. Fire losses, on the basis of cents per $100 of insurable value, have shown a steady decline since 1951.

A breakdown of the figures, compiled by the American Petroleum Institute's department of technical services, shows that drilling is the most hazardous job in oil, both in the frequency and severity of accidents. Seagoing-marine operations and retail marketing are also high in frequency but much lower in severity.

## Halliburton to Buy Otis

OTIS Engineering Co. of Dallas, an oil well servicing equipment firm, later this month is expected to become a wholly-owned subsidiary of Halliburton Oil Well Cementing Co., Duncan.

Otis is being purchased by Halliburton for 212,343 shares of Halliburton stock, valued at $13,800,000. Otis stockholders will vote on the proposal June 24. Directors of both companies have approved the deal.

The Otis company was formed by H. C. Otis, still chairman of the board, more than 20 years ago. Robert H. McLemore is Otis president and H. C. Otis, Jr., is executive vice-president. The three will hold these same positions in a new Delaware corporation, to be formed as a Halliburton subsidiary.

Officers of both companies said products of the companies are not competitive but complimentary. The Otis plant in Dallas will continue in operation and the 650 employes will not be affected by the change. Otis has sales and service offices in Texas, Oklahoma, Louisiana, New Mexico, and Mississippi and operations in Venezuela and Canada.

completed next month and the other three at a second station will be completed late this year. The 63-mile 30-in. line from Raudatain to Ahmadi North tank farm also will be finished late this year.

**Two 12-in. projects** are planned by Great Lakes Pipe Line. Bids are due this week on 64 miles from Iowa City to Princeton, Iowa, and 62 miles from Cordova to Lee Center, Ill.

**Construction contracts for 21.5** miles of 30-in. from Welda to Princeton, Kans., and 25 miles of 12-in. from Hutchinson to Ellsworth, Kans., have been awarded to Vaughn & Taylor by Cities Service Gas. Trojan Construction Co. is laying 16 miles of 16-in. for Cities Service in Kansas and Missouri.

**Bids will go in this week** on the 350-mile 30-in. Midwestern line from Portland, Tenn., to Joliet, Ill. It will be awarded in seven sections.

## *Also for Pipeliners . . .*

**IN THE NEWS:** Supreme Court rules dividends to shipper-owners must be based on full valuation of crude pipeline (p. 64) . . . FPC is taking a look at favored-nation clauses in gas contracts. May prepare test case to toss them out (p. 64) . . . Texas Electric Service Co. confirms it plans a $25-million gas pipeline project from Old Ocean field to Fort Worth and North Texas (p. 67) . . . Monterey goes into the gas-pipeline business on intrastate basis (p. 71) . . . Lebanon will more than triple its payments from IPC line (p. 81).

A complete list of pipeline construction contracts is carried in the last issue of each month. Current projects are carried in pipeline briefs.

**PLUS THESE TECHNICAL REPORTS:** Spheroid separates batches in products pipeline (p. 86) . . . Fighting corrosion in the desert (p. 124).

# Low-Cost Research Used to Study Floods

OIL RESEARCH isn't always expensive.

With a little ingenuity and mechanical ability, it can come pretty cheap.

For instance, Atlantic Refining Co. found recently that it was unable to buy a tiny positive-displacement, constant rate pump it needed to pump fluid into a model reservoir at its Dallas research and development laboratory.

With the miniature reservoir or observation cell and a suitable pump, Atlantic technicians planned to run detailed studies on water-flood mechanics.

Unable to buy a pump, Atlantic's Ben Caudle and Eddie Cooper designed and built one at a very nominal cost. Caudle is a group leader at the lab, while Cooper is a senior research technician.

Here are its components:

**...A small hypodermic syringe.** The syringe (regular medical variety) serves as vital innards of the pump—the piston and cylinder. Cost? About $2.00.

**...A small electric motor** (of the type used to power window displays) to operate the syringe. Cost? About $4.00.

**...The gear-reduction assembly** from an old strip-chart recorder. The assembly, coupled to the motor, steps up the volume of fluid that can be pumped.

The glass syringe has proved surprisingly durable. Normal operating pressure varies from 1 to 10 psi. But pressures as great as 50 psi. have been used, and the syringe hasn't broken.

**"Reservoir" cheap, too . . .** Even with the gear-reduction assembly, Atlantic's little pump isn't likely to break any injection volume records.

Caudle figures it would take it about 1,000 years at normal operating rate to pump a full barrel of oil.

But then the "reservoir" it is pumping into isn't big either—only about 0.007 in. thick. To make it, Atlantic technicians place two 0.007-in. wires half an inch apart on a small rectangle of plate glass. The area between the wires is filled with sand or crushed glass to simulate sand. A second piece of glass is cemented on top. Flexible clear plastic tubing carries the fluid from the pump to the observation cell.

Connate water is created in the reservoir by pumping in brine then pushing out the excess brine with "reservoir oil." Gas, in the desired quantity, is dispersed throughout the oil.

With this type of setup, Atlantic has conducted exhaustive studies, for instance, of how residual oil is left behind in a water flood and how it can be reduced. It has used it also to study when gas starts coming out of solution with oil as reservoir pressure drops as a guide to determining when would be the best time pressure-wise to start a flood.

**TINY** home-made pump is hooked up to a model reservoir at Atlantic Refining's lab to study how to get more oil from a real reservoir. Ben Caudle, group leader who helped design the pump, adjusts pumping rate.

**More ingenuity . . .** Atlantic technicians study the results of such a project in the model reservoirs with the aid of microscopes and cameras.

The company has several photographic rigs to make still and motion pictures of the reservoirs—all made by Caudle.

One of Caudle's concoctions photos and magnifies at the same time. This operation is used to photograph sections of the reservoir and show residual oil left behind by a water flood. Such pictures are taken by attaching the back of a Polaroid camera to an old Graflex single-lens reflex camera. The resulting product is hooked up to a microscope using a 35-mm. microscope adapter.

Caudle made another still-picture apparatus, this one to make negatives, from an old photographic enlarger and an electronic flash unit. The model reservoir is placed in the enlarger and the image projected on a strip of film, making a 4 by 12-in. negative.

# Producing-Depth Record Is Threatened

JOHN MECOM, Houston, may know this week whether he has the world's second deepest producer—as well as the deepest.

Testing is under way below 20,000 ft. on the John Mecom-Magnolia Petroleum Co.-Ed Hill-Louisiana Land & Exploration Co. Unit Q No. 2, in Plaquemines Parish, Louisiana.

The well drilled by Mecom, is about 2 miles southeast of the world's deepest producer at 20,741-45 ft. This is the Richardson & Bass et al. No. 1, also a Mecom well, which once held the total depth title at 22,570 ft.

A Mecom spokesman said the new well was bottomed at 20,752 ft., but will not produce at that depth. However, three or four tests are being made below 20,000 ft. Results of the test were not being reported last week. If the tests are good, the well may be deepened and could become the world's deepest producer.

# Hassi Messaoud Gets 5-Mile Extension

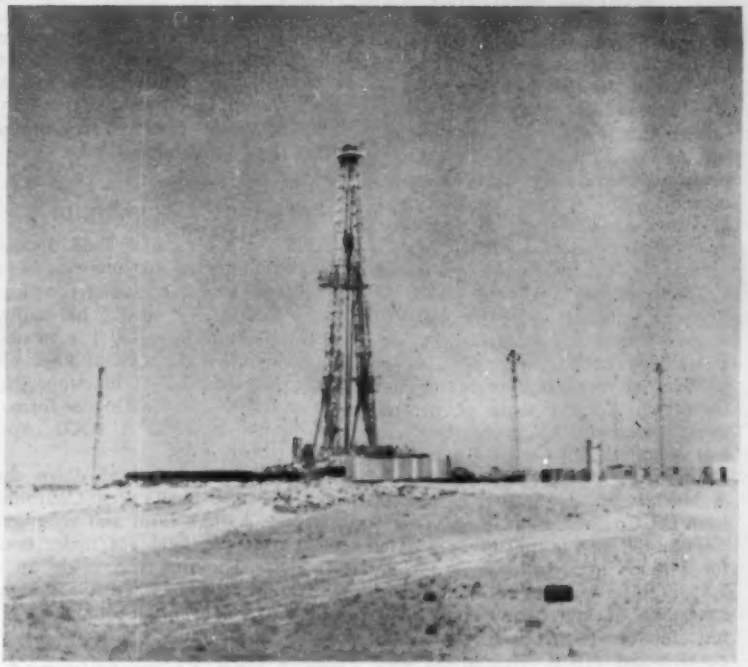
A SUCCESSFUL step out has extended Algeria's big Hassi Messaoud field further to the northeast.

The Oml 75 is not the most northerly or easterly well in the field. But as a well 5 miles from the nearest other producers, it adds a big bulge to the northeast flank of the proven producing area.

C. F. P. (A), the Saharan affiliate of Cie. Francaise des Petroles, considers the new well an important success for several reasons. Besides confirming the extension of the field in a new direction, the well came in as a good producer with a 295 ft. pay of high porosity.

Tight porosity in the 30 wells completed earlier is one of the chief problems in operating the field, which covers more than 500 sq. miles. This has also held down the reserve estimate to 3.5 billion barrels, estimated on a 20% recovery of oil in place (OGJ, May 25, p. 114).

C. F. P. (A) is developing the north portion of the field, and another French company, S. N. Repal, is operating in the south portion.



# Lebanon Gets Bigger Bite From IPC

**• Pipeline payments will be jumped from $1 million to $3.4 million a year under the new agreement worked out with Iraq Petroleum. Lebanese will now turn attention to getting higher transit fees from Tapline.**

THE LEBANESE Government and Iraq Petroleum Co. have ended years of bickering over pipeline transit payments with an agreement that will more than triple fees paid to Lebanon.

The agreement is a package deal covering transit revenues and past claims by the government. It also touches on marketing and social services by IPC in Lebanon. The new arrangement will go into effect when the government ratifies other agreements covering operations of the company within the country.

Lebanon will receive $3,450,000 a year in transit fees under the new agreement. The government now receives about $1 million. IPC moves about 150,000 bbl. daily to Tripoli through a 16-in. fork of its pipeline system to the Mediterranean.

IPC will pay a lump sum of $16.3 million in settlement of all past claims on the company by the government. This includes claims of transit dues from 1952. The company also will make available to local marketers of government choice 20% of the products from the company's 11,550-bbl. refinery at Tripoli.

Among the other provisions of the agreement, IPC will support a technical trade school to be established at Tripoli. It will also distribute nearly $100,000 a year among the towns where the company operates.

The agreement was reached after weeks of negotiations by teams of six IPC staffers, headed by G. H. Herridge, managing director, and six government representatives. But the talks had been in progress, sometimes heatedly, on and off for a number of years.

**Tapline next . . .** The Lebanese say they will next start talks with Trans-Arabian Pipeline Co. over an increase in Tapline's transit fees. Deliveries of Saudi Arabian crude to Sidon, Lebanon, terminal have averaged nearly 390,000 bbl. daily this year, several times greater than shipments to Tripoli by IPC.

Three years ago, Tapline offered to convert to a commercial profit-making firm, and split profits 50-50 with the countries through which the 1,067-mile pipeline passes. These are Saudi Arabia, Jordan, Syria, and Lebanon. But in the troubled political times since then, a decision has not been made on the proposal.

## Spain Is Hopeful

### . . . of first find after oil shows in Valdebro wildcat. Tests are continuing.

ENCOURAGING OIL shows in northwest Spain may mean the country has its first discovery.

Word of the find came on the eve of a new oil law designed to attract foreign companies to Spain and Spanish Africa. The new law was expected to become effective June 13, offering a 50-50 profit split with a provision for depletion. It will open Spain and Spanish areas to 100% foreign oil ventures for the first time.

The apparent find was made in Retuerta 1, North of Burgos, by Valdebro. This is a joint Spanish American exploration company, owned 50% by the local Institute of National Industries. Largest share of the remaining half interest is held by General American Oil Co. of Texas, with about 53%. Others include DeGolyer & MacNaughton, Delta Drilling Co., Lion Oil Co., and E. E. Fogelson.

The well had a steady light flow for 3 hours in a drill-stem test from 7,853-7,941 ft. The formation was sandstone of low permeability. The test recovered 1,000 ft. of water cushion and 710 ft. of mud cut with much green oil in the bottom 110 ft. Pressures were low. Initial flowing pressure was 555 lb. Final flowing pressure was 695 lb. Shut-in pressure was 1,175 lb. The wildcat will continue drilling, coring, and testing.

Gas, and in at least one case, oil shows have been found in several wildcats drilled in Spain, but none has ever been commercial.

A well at Alda in northeastern Spain had several gas shows which are now being tested by CIEPSA-C. Deilmann. The well was bottomed at 16,474 ft.

The Valdebro find many increase interest in the Spanish mainland, but most attention is now centered in Rio de Oro, the Spanish Sahara. About 20 companies were waiting for bidding to open on nearly 10 million acres of the African area. But reports from Africa last week were that enthusiasm had cooled as the result of surface reconnaissance. While surface work is still limited, initial results reportedly indicated poor reservoir conditions and lack of good folding.

### French Find Commercial

THE ROYAL Dutch-Shell discovery well southeast of Paris has been completed as a commercial producer with a flow of 300 to 375 bbl. daily.

St. Martin de Bosseney 1 is located about 65 miles southeast of Paris. It produces from a 243-ft. limestone section at the top of the Dogger formation, found at 4,500 ft. (OGJ, Apr. 27, p. 105).

Crude is being barged down the Seine River to Shell's Petit-Couronne refinery. A tank farm and river terminal near the field are under construction. The find was made on a concession held by COPESEP, controlled by Shell group companies.

### Israel Line Being Enlarged

FIELD WORK has started for a $20-million expansion of Israel's Eilat-Haiga pipeline system.

The project will consist of replacing a 125-mile 8-in. section from Eilat to Beersheba with 16-in. pipe. The rest of the 250-mile crude carrying system already has 16-in. line.

Construction bids will be opened June 30. The contractor winning the contract will be expected to start laying pipe this summer and complete the job within a year. The new section will increase capacity of the system to 100,000 bbl. daily from the present 23,000 bbl. daily.

## French Grant Areas

### . . . in Algeria to Jersey, other major companies.

THE last legal hurdle in the way of an oil hunt by Jersey Standard in the Algerian Sahara has been cleared with the official approval by the French Government.

A 7,940-sq.-mile block along the Tunisian border, which Jersey has agreed to explore jointly with French companies, was one of 10 areas covered by new exploration permits issued in Paris. No date has been set for the start of work on the Jersey acreage, but a company official last week left for France to discuss details of the exploration program.

The block stretches for 180 miles along the southern border of Tunisia, with the southernmost corner of the acreage touching on the Libyan frontier. The concession lies 110 miles due west of Hassi Messaoud field, and 170 miles north of the fields in the Edjele area.

The two French partners will be CFP (A) with 35% and Petropar with 15%.

**Phillips permit . . .** Other awards included a 232-sq.-mile block issued to Phillips Petroleum Co. and two French firms, Omnirex and COPEFA. The acreage lies 93 miles southwest of Hassi Messaoud.

Ste. des Petroles de Valence, 50% owned by British Petroleum Co. and its French subsidiary, acquired three blocks in the eastern Sahara totaling nearly 700 sq. miles.

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# *FOREIGN BRIEFS . . .*

**A $13-million drilling contract** for 300 wells has been awarded by Argentina to Saipem, an Italian company jointly owned by Soc. Nazionale Metanodotti and an ENI subsidiary, AGIP Mineraria. The wells will be drilled on the south flank of Comodoro Rivadavia field.

**Two Venezuelan newcomers** have given up concessions along the Colombian border they were obligated to take in 1956 when bidding for choicer acreage in Lake Maracaibo. Signal Oil & Gas of Venezuela has renounced 75,000 acres in Zulia. Superior Oil of Venezuela has turned back 25,000 acres in Apure.

**Texas Petroleum** is calling off its exploration program in Peru and giving up 3 of the 5 million acres it holds under concession. Texaco for years has wildcatted both in the Sechura desert area on the Pacific Coast and in the country's Amazon basin area without a commercial find.

**Commercial production** has started from a new Russian field at Kotur-Tepe, Turkmenia, across the Caspian Sea from Baku. The first well is flowing 700 bbl. daily, and several more will be opened soon. The oil is being delivered by pipeline to Krasnovodsk refinery.

**Contract for** a $21,000,000 expansion program at the Salamanca, Mexico, refinery of Pemex, including a 220-ton per day anhydrous ammonia plant, has been awarded Lummus Co. Additions to the refinery include vacuum distillation, catalytic cracking, gas recovery, catalytic polymerization and treating units.

**Russia** plans to increase exports of crude and products to France next year to 9,500,000 bbl. Red shipments to Italy this year are expected to reach 16,000,000 bbl.

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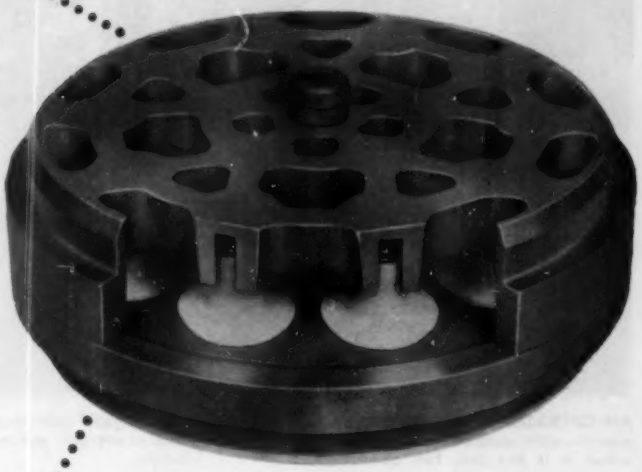

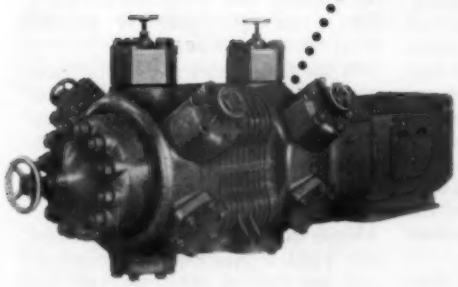

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**AN OPERATOR** sits in air-conditioned comfort in the highly instrumented control room of the Ain Dar gas-injection plant—with outside temperature above 100°. The plant will return 200,000 M.c.f. of gas daily to the producing zone when it is put into full operation.

# Gas Conservation Becoming Popular in

**• The Arabs are beginning to frown upon flaring, even though Middle East gas has no market as a fuel. Aramco is the acknowledged leader in the trend to reinject the gas to maintain reservoir pressures.**

(Ninth in a series of Special Foreign Reports)

**Paul E. Swain**
International Editor

THE MIDDLE EAST is fast becoming an area where "flare" is almost as much a dirty word as it has become in Texas. The sight of burning gas is just about as offensive to the Arab eye as to a member of the Texas Railroad Commission.

There is one basic difference. There is no market for Middle East gas as a fuel. A European gas industry could thrive on it, but so far no one has developed an economical way to move Arab gas to Europe's mains.

There are those in the Middle East who say, with economics textbook logic, that flared gas in this part of the world is not being wasted. They insist that you can't waste what has no value. There is no price tag on Middle East gas—yet.

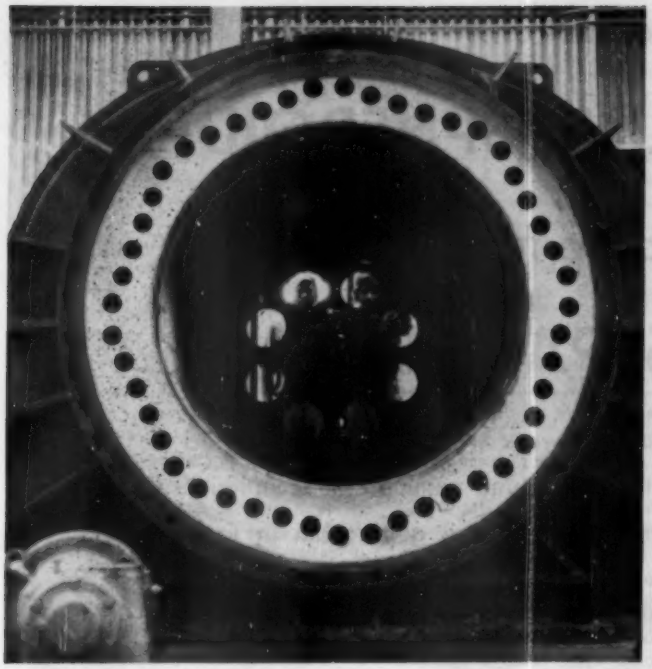
The Middle East trend is gas injection to maintain reservoir pressures and produce more of the oil in place.

Arabian American Oil Co. is easily the leader and will probably stay out in front for a long time to come. Aramco has been reinjecting gas into one of its bigger producing reservoirs for 5 years. The company is prepared to double the volumes of gas used in this manner with a newly completed plant which cost more than $27½ million. Later additions to the original plant will boost the volumes recycled even further.

The Abqaiq injection plant, built in 1954, was expanded last year and is now returning 214,000 M.c.f. of gas to the reservoir. The newly completed Ain Dar injection plant at the north end of the huge Ghawar field will return another 200,000 M.c.f. of gas daily to the producing zone as soon as it goes into full scale operation. Additional compressor capacity for Abqaiq will boost the injection rate at the older plant to 260,000 M.c.f. when it is installed.

When both plants are in operation, Aramco will be either injecting or using for fuel and electric power production more than 66% of the gas which it produces. This is gas which was flared only a short time ago.

**Abqaiq injection . . .** Since the shiny, new plant at Ain Dar was completed and got lots of attention, the men who operate the older Abqaiq injection plant look proudly at their mixture of equipment and compressors with the affection of a man who scorns to compare his dray horse with a sleek, younger thoroughbred.



**TWO SAUDIS** peer through ports of a section of one of the big 8,500-hp. gas turbines at the recently completed Ain Dar injection plant at Ghawar field.

**BRIEFING** Paul Swain, Journal international editor (left), on Abqaiq plant is Ed Hemmila, petroleum engineer.

# Saudi Arabia

"She may not be pretty, but she sure gets the job done" is the way Frank Byrd, the Abqaiq plant foreman expresses it.

The Abqaiq plant draws its supply of the high pressure, 500 psi. produced gas from the three big 100,000-bbl. gas-oil separators in the field. The gas is moved to the plant by a 22-in. transmission line and goes through a 3-stage compression cycle before injection.

The first stage to bring the pipeline gas back up to 400 psi. is handled by two 2,500 hp. centrifugal compressors in parallel. Another pair of identical compressors handle the second compression stage and deliver the gas at 800 psi. to the final stage where four reciprocal compressors move it up to 2,100-2,400 psi. for injection.

The gas is delivered at this pressure to three injection wells in the southern part of Abqaiq field by high-pressure flow lines.

Aramco's reservoir engineering studies indicate that a million feet of gas injected at Abqaiq displaces 790 bbl. of crude. The injection of 200,000 M.c.f. daily accounts for 158,000 bbl. of crude by simple displacement. The plant is now topping its design capacity by 14.000 M.c.f. daily.

Since the Abqaiq injection plant went into operation it has returned about 217,940,000 M.c.f. of gas to the producing reservoir.

**Ain Dar plant . . .** The new plant in the northern part of the 160-mile-long Ghawar field was built for Aramco by International Bechtel Builders at a cost of $27,600,000. After appropriate dedication ceremonies, the plant operated perfectly for 45 hrs. before a high-pressure gas line to three injection wells failed.

The line break tossed about 2,000 ft. of heavy-wall 14-in. pipe over the desert like so much spaghetti. Then an oversupply of gas in one of the five big gas turbines damaged an exhaust stack.

While the big, modern, automatically controlled Ain Dar plant goes through a shakedown period to rid it of all the bugs, Frank Byrd and his Saudi operators at Abqaiq listen with smug satisfaction as their workhorse plant purrs along.

The Air Dar plant takes its injection gas from three big gas-oil separators in the Ain Dar section of Ghawar and a fourth at Shedgum. The 175 psi. gas goes through a 5-stage compression cycle powered by five 8,500 hp. gas-turbine driven centrifugal compressors to a final injection pressure of 2,200 psi.

The compressed gas leaves the plant by two 14-in. high-pressure lines which serve three injection wells each, some of them as far as 14 miles from the plant.

**Water injection . . .** In addition to the gas-injection program, Aramco is giving Abqaiq's active water drive a helping hand with the injection of from 225,000 to 250,000 bbl. daily of water into eight water intake wells on the northern perimeter of the field.

The water is obtained from a high pressure water zone found at about 3,500 ft.

The company plans to add another 50,000 bbl. daily of Persian Gulf water through a ninth well in a pilot-plant operation to determine the feasibility of large-scale Gulf water injection possibilities in Ghawar if such a development should prove necessary in the future.

The sea water injection program has been held up by engineering and mechanical problems with strainers for the 10 and 12-in. pipeline drawing water from the highly saline gulf. It is expected to get under way this year.

# THE PIPELINE SPHEROID

## . . . an effective technique for

# FLUID SEPARATION

**"The very encouraging results of our work with spheroids have led to the establishment of what appears to be a sound commercial technique for the minimization and control of interfacial mixture generation in long lines."**

**PART 1 OF TWO PARTS**

SHELL OIL CO. has been working toward the eventual development of a full-scale batch-separation program for its 14-in. 250-mile Wood River-Chicago products line.

This will provide for the introduction of expandable elastomer spheroids at properly spaced intervals into the interfacial mixture between incompatible products at the source of the line and the subsequent maintenance of their relative positions in the stream to destination. As a result of full-scale testing of the action of spheroids in this pipeline, graphs are presented which show some of the effects found in varying the number, size, and spacing of them as well as their over-all effectiveness as mechanical separating devices for petroleum liquids.

Equipment has been developed for the precise high-speed launching of multiple spheroids. An automatic spheroid bypass is under development to permit their passage through intermediate booster pump stations without disturbing their relative position in the flowing stream or the normal liquid-flow pattern through the station during their transition.

Among the advantages of spheroids are the ease with which they can be manipulated by gravity, their relatively lower cost, and their ability to nullify forward diffusion while substantially minimizing backward diffusion. In combination with automatic handling equipment, they offer a practical system for effecting savings by minimizing and controlling interfacial mixture generation to approximately one-third of what it would otherwise be without mechanical confinement.

The commercial possibilities of extending the usage of long pipelines to the transporting of more varied liquids, the problems of two-phase pipelines and the requirements for holding critical specifications of petroleum liquids at pipeline destination have led engineers through many ideas and much experimental work on ways to separate fluids moving contiguously through a common pipeline.

Paper presented at the tenth annual pipeline conference, under auspices of API Division of Transportation, Pittsburgh, May 13 and 14.

**BY M. L. BARRETT, JR.**
Senior Engineer, Research and Development Department, Shell Oil Co., Indianapolis

The most commonly accepted procedure to date seems to be the use of a simple disk or cup-type scraper (Fig. 1) as a mechanical partition or a buffer tender as a liquid separator or a combination of both.

### Disk-Type Mechanical Separator

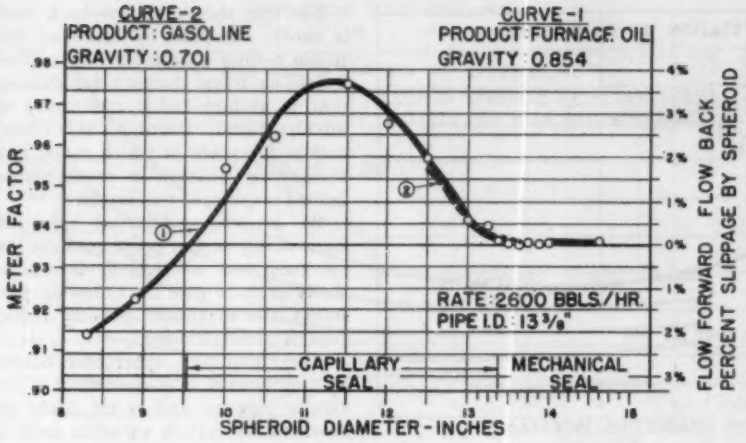
A number of years ago a relatively extensive investigation in Shell's 8-in. diameter products lines showed that just one scraper per interface could appreciably reduce the normal spread of an interface. And the more of such properly spaced scrapers or "dumbbells" that were used per interface the better the liquid separation.

As a result a procedure was evolved wherein liquid buffer tenders are used as usual, but in addition one double disk-type separator scraper is used at each end of an interfacial mixture where the protected products are not compatible.

If two such scrapers are properly

**SCRAPER** for separating products. Fig. 1.

**SPHEROIDS** are a new technique. Fig. 2.




**SLIPPAGE OF PRODUCT** past a spheroid of varying size is shown. Fig. 3.

spaced and located at an interface they have the ability to reduce an interfacial volume at destination to about 75%-80% of its unprotected volume. This two-scraper system of interface protection is still being used in several of Shell's lines today.

But there are a number of disadvantages in using disk or cup-type scrapers in a long pipeline. Primary among these are:

- **Insufficient protection** against mixing because of the limitation as to the number which can be used in an interface using conventional scraper barrels.
- **Rubber cost.**
- **Labor cost** to handle and maintain.
- **Relatively short life.**
- **Mechanical and control difficulties** encountered in the manipulation of scrapers at or through booster pump stations along the line.

To eliminate as many of these disadvantages as possible we started working a number of years ago with the elastic spheroid-type separator of Fig. 2 in our 14-in.-diameter, 250-mile-long products line from Wood River to Argo, Ill., and East Chicago, Ind.

### The Technique of Spheroidal Separation

The suitability of a spherical configuration for a solid object intended for passage through closed conduits with fluid energy has been established for many years. The very encouraging results of our work with spheroids have led to the establishment of what appears to be a sound commercial technique for the minimization and control of interfacial mixture generation in long lines.

In concept this essentially involves (1) the bracketing or confining of an originating volume of interfacial mixture existent between two incompatible fluids at the source of a pipeline by the critical placement of the desired number of spheroids in that interface and (2) the movement of those spheroids (or substitutes) in that same relative position in the fluid stream to the end of the pipeline.

There are certain elements which are critical in both of these essential parts of the technique. For this reason it was necessary to develop accurate high-speed hand-sampling procedures and to test a number of types of spheroids and schemes of placement. It was also necessary to design and construct special types of spheroid launching and handling equipment to take full advantage of the potential of the spheroid as a fluid-separating device.

### Description of Spheroid

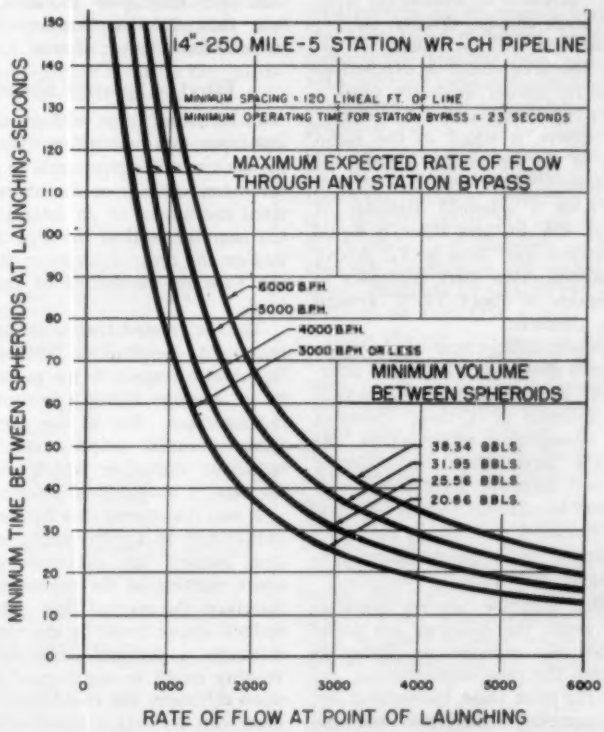
Although experimental spheroids used several types of solid cores including aluminum and even wood, spheroids produced today are made of two hemispheres of molded elastomer and then vulcanized into a hollow, expandable sphere. Natural rubber, Hycar, Neoprene, and Adiprene have been tried in hardnesses from 45 to 65 Durometer.

Neoprene having a hardness of 45-50 Durometer appears to be the best for long-line service where the immersion is intermittent. Our work has been done with 8, 12, 14, and 16-in. spheroids. The 14-in., which we have used most extensively, have a wall thickness of 2¼ in.

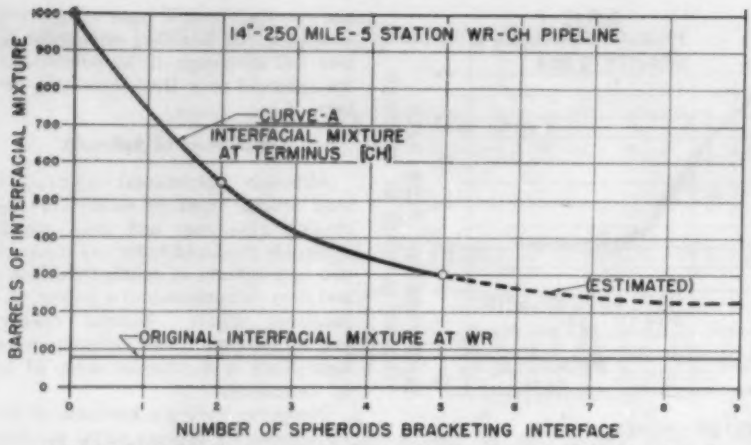
They are pumped hydrostatically full of water (and ethylene glycol if necessary) through a small valve recessed in the wall of the spheroid. They must be voided of all air or gas to retain their correct diameter under variable pipeline pressures.

### Fluid Separation

The relationship of the minor diameter of a spheroid (measured at at-


14"-250 MILE-5 STATION WR-CH PIPELINE
MINIMUM SPACING = 120 LINEAL FT. OF LINE
MINIMUM OPERATING TIME FOR STATION BYPASS = 23 SECONDS
MAXIMUM EXPECTED RATE OF FLOW THROUGH ANY STATION BYPASS
6000 B.P.H.
5000 B.P.H.
4000 B.P.H.
3000 B.P.H. OR LESS
MINIMUM VOLUME BETWEEN SPHEROIDS
38.34 BBLS.
31.95 BBLS.
25.56 BBLS.
20.86 BBLS.
MINIMUM TIME BETWEEN SPHEROIDS AT LAUNCHING-SECONDS
RATE OF FLOW AT POINT OF LAUNCHING

**MINIMUM SPHEROID LAUNCHING SPACING** at sources of 14-in. pipeline. Fig. 4.




**INTERFACIAL MIXTURE** is plotted against the number of spheroids. Fig. 5.

mospheric pressure) to the inside pipeline diameter is critical. Fig. 3 shows the results of tests of varying sizes of spheroids in a 13⅜-i.d. pipeline made by noting the change in a positive-displacement meter's factor at the end of a 1-mile unidirectional displacement-meter prover.

All tests on Curve 1 were made in the same batch of furnace oil at a 2,600-bbl. per hour flow rate. If we visualize a sphere the size of a golf ball or a baseball traveling with the flowing stream, great quantities of the fluid will rush past the small sphere, giving us an erratic amount of "flow forward" across it depending on pipeline elevation change, density, etc.

As the size of the sphere is increased, the area which is exposed to the velocity forces increases until a diameter is reached where the velocity of the sphere is equal to the mean velocity of the stream for a given set of conditions. This occurs in Fig. 3, Curve 1, at a spheroid diameter of just over 9½ in. and there is equal flow forward and "flow back." Above this diameter, flow back increases to a maximum of about 3¾% around 11½-in. diameter.

Continued enlargement of the spheroid closes down the flow-back interstice until the condition of mechanical seal is effected at 13⅜-in. diameter and a squeegeeing action exists. At about 1% larger than this diameter a full and effective mechanical wiping action by the spheroid is obtained and any further increase in the spheroid diameter serves no useful purpose in reducing flow back.

Further increase of its diameter simply wears the spheroid out faster and does not increase its ability to reach into the pipe imperfections and remove the prior fluid. Indications are, from sampling long-line intermix spread, that the flow back across a spheroid inflated to the optimum diameter of about 1% larger than the pipe i.d. is about 0.02-0.04% of the total volume displaced. Thus the flow back from front to rear of a properly sized spheroid is minimized but it can never be eliminated.

Observing Fig. 3 again it may be seen that it is necessary to expand all spheroids used to protect an interface to the optimum diameter. For if one of a series is too small it will eventually move downstream until it is "back-to-back" with its downstream neighbor. Similarly, if all the spheroids used to protect an interface do not have the same wear and/or swell characteristics they may sooner or later lose their relative positions in the stream from change of size.

### Effect of Spheroid Spacing

In turbulent flow, without mechanical separators or barriers, liquid near the center of the pipe tends to gain on the mean velocity or the average forward movement of an interface. Liquid near the wall of the pipe tends to lose on the mean velocity or the average forward movement of the interface.

Thus is created both a forward and backward longitudinal diffusion of liquid with respect to the mean velocity or average forward movement of the interface. But at the same time there is radial velocity resulting in turbulent diffusion which decreases the rate of longitudinal intermixing.

It was discovered that by inserting a multiplicity of tightly sealing mechanical barriers an optimum distance apart, starting at the beginning of an interface, the normal flow pattern described above could be changed. Substantially a uniform cross-section of velocity could be maintained and forward diffusion was eliminated because there can be only a flow-back condition across each mechanical barrier of a spheroidal nature.

The thin sheath of flow-back fluid is slowly absorbed by turbulent diffusion behind a spheroid but requires a definite travel distance for this action to restore radial uniformity of mixture blend. Based on this observation, the point at which radial uniformity of mixture is re-established behind a spheroid was found.

By inserting additional spheroids successively at that point until the last spheroid was inserted in liquid radially uniform with the following pure liquid, the maximum possible reduction of mixing resulted.

This minimum spheroidal barrier spacing is extremely critical for a particular pipeline and is no doubt influenced by certain variables such as the relative viscosities of the facing liquids and the pipeline "C" factor. But for practical commercial purposes this optimum spacing between spheroids in Shell's 14-in., 250-mile products line has been found to be approximately 120 lineal ft. of line for the particular products handled.

However, this theoretical optimum spacing of spheroids in an interfacial mixture at the source of a pipeline may be influenced by practical and financial considerations which may dictate that spheroids be spaced at intervals greater than the optimum spacing.

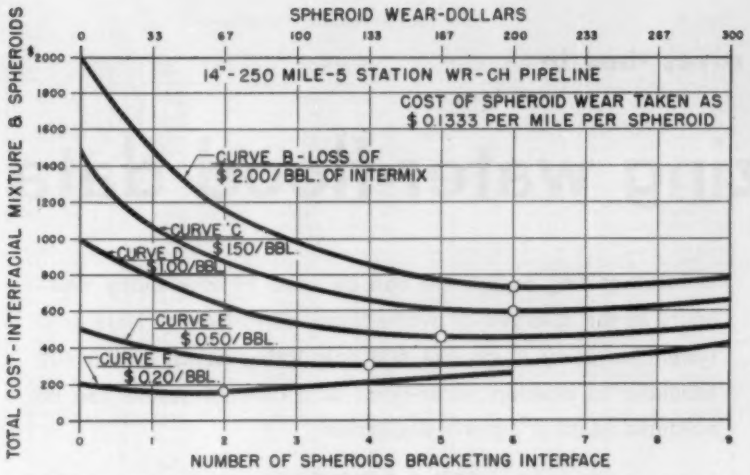
Looking first at the practical considerations, it is normally necessary to take such spheroids past one or more booster pump stations on a line. Such stations may employ automatic station bypasses, such as later described, to form a fully integrated automatic system for getting the spheroids through the stations without taking the pumps off the line yet at the same time keeping each spheroid in its exact relative position in the stream.

Such bypasses as built by Shell require a minimum of 23 seconds to get any one spheroid across the station. Therefore, no spheroids can be expected to properly traverse such a bypass if they approach a station less than 23 seconds apart.

Fig. 4 shows the minimum spheroid launching spacing in seconds for a minimum allowable spacing of 120 lineal ft. apart and a 23-second time requirement for any automatic station bypass. Such a graph may be plotted to fit the conditions of any pipeline.

Looking now at Fig. 5 we note that the greater the number of spheroids used to bracket an interfacial volume the better the protection afforded it. But it is evident that there is a diminishing degree of protection to the interface as the number of spheroids employed is increased.

Ultimately the point is reached




**OPTIMUM NUMBER** of spheroids to produce minimum dollar loss. Fig. 6.

where the further addition of spheroids gives no appreciable added protection because optimum minimum spacing has been reached and the interface completely bracketed. For instance, on our line with no spheroidal protection approximately 1,000 bbl. of mixture is generated, with two spheroids about 550 bbl., with five spheroids about 300 bbl., and with nine about 250 bbl.

With this expected interfacial mixture vs. number of spheroids curve, and knowing the dollar value per barrel of spoiled or degraded interfacial mixture and the cost of running spheroids as protective devices, we can plot a graph such as Fig. 6. It shows the most economical number of spheroids to use to protect any given interface. In general, the greater the dollar loss per barrel of intermix the more spheroids we can afford to use per interface for maximum savings.

The spacing of spheroids in an interfacial mixture may then be summed up in the light of these facts as follows:

1. The first spheroid must be inserted right at the head end of the originating interfacial mixture.

2. Subsequent spheres, up to the maximum economical number indicated by a graph such as in Fig. 6, must be equally spaced throughout the interfacial mixture or permitted to extend into pure liquid following the interfacial mixture. Their minimum volumetric spacing must be the greater of (1) the volume contained in 120 lineal ft. of line or (2) the volume which will pass through any ancillary spheroid-handling system (such as an automatic station bypass) in its minimum cycling time.

3. The maximum spacing between successive spheroids should be maintained as close as possible to the minimum spacings specified above. This is provided that, in any event, the optimum economical number of spheroids chosen must equally subdivide the original interfacial mixture and bracket it with the final spheroid in substantially pure liquid at the end of the interface.

**"In general, the greater the dollar loss per barrel of intermix the more spheroids we can afford to use per interface for maximum savings."**

### Spheroidal Product Separation

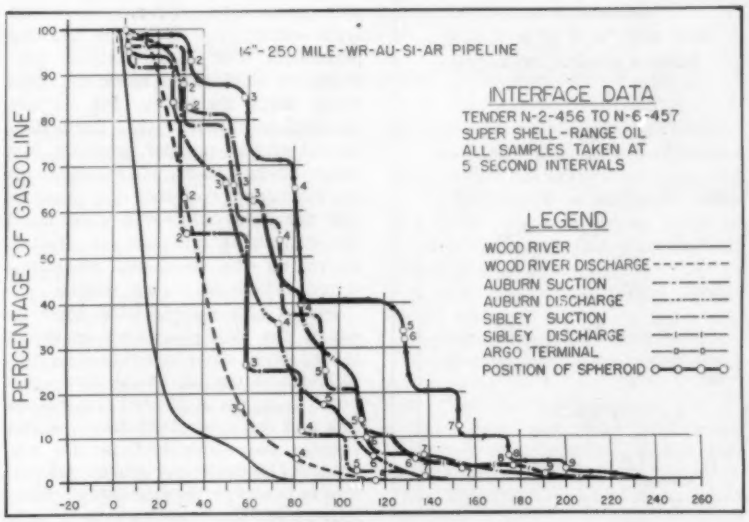
Although construction of all the automatic spheroid-handling equipment intended for Shell's Wood River-Chicago line has not yet been completed, a number of test runs of spheroid-protected interfaces have been made through the line with some manual control. These test runs have proven the feasibility of spheroidal separation.

Recalling that the interfacial mixture at Chicago with no mechanical separation is approximately 900-1,000 bbl., we have separated batches of motor-grade gasoline from range fuel with two, five, and nine-spheroid runs.

The results are consolidated on the graph of Fig. 5, but, to illustrate the detailed nature of the protection which can be afforded an interface, Fig. 7 shows the results of protecting an originating interface of 118 bbl. at Wood River with five spheroids at 30-bbl. intervals to Auburn (78 miles), then seven spheroids to Sibley (155 miles), and nine to Argo (250 miles).

Even though the manual spheroid handling caused several of the spheroids to be misplaced in this interface, it was brought into Argo with about 240 bbl. of mixture. We were trying to get a picture of the best possible reduction of interface with nine spheroids and that this 75% reduction with nine spheroids may not necessarily be the most economic procedure for us to follow for all interfaces. We believe that four or five spheroids out of Wood River will perhaps be more realistic when completion of construction will permit more testing.

**Part 2 will discuss problems and techniques in launching and handling the pipeline spheroid.**




**RESULTS OBTAINED** here are with nine spheroids protecting the interface from Wood River to Argo, Ill. Fig. 7.

**How computing machine saves time in**

# Analyzing water-flood data

**Data-processing equipment can be used to save many man-hours in the analysis of water-flood performance. Here is a system for using in an IBM 604 calculating punch and a 407 tabulator to develop water-flood data. Similar results can be obtained on other types of equipment.**

**BY R. C. EARLOUGHER**
Earlougher Engineering, Tulsa

A DATA-PROCESSING PROGRAM such as the one described here offers several important advantages. It provides far more detailed information every month than could otherwise be obtained economically. It frees engineers from time-consuming detail work so they can concentrate upon analyzing flood performance. It allows trained engineers or experienced operators to review a flood's progress almost at a glance each month.

Data used by the calculator and tabulator consist of: (1) field-performance data on both injection and production wells; and (2) permanent well data which are stored in cards. From these data, the machines compute and record both specific analytical data on the performance of each individual injection and production well and summary figures for over-all water-flood performance.

All performance data used in this paper are from a five-spot water flood in northeastern Oklahoma (Fig. 1).

Presented at the API Mid-Continent District spring meeting, Amarillo, Tex., under the title, "Use of Data-Processing Equipment for Analyzing Water-Flood Performance Data."

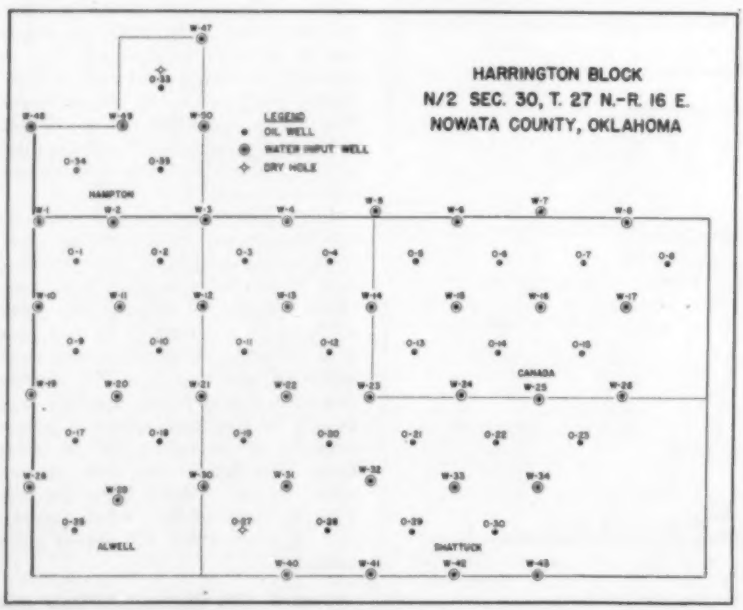
EARLOUGHER ENGINEERING
WATER INJECTION DATA

COMPANY NO. ____(1-2)
LEASE NO. ____(3-4)
MONTH_____
PAGE NO. ____

| (5-9) WELL NO. | (10-13) PRESSURE | (14-20) LAST METER READING | (21-22) DAYS ON |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

AVERAGE PLANT PRESSURE _____

**FIELD WORK SHEET** for recording monthly water-injection figures. Data from this form is punched onto IBM cards. Fig. 2.




**MAP OF THE WATER-FLOOD PROJECT** in northeastern Oklahoma from which the data for this paper were obtained. Fig. 1.

### Injection-Well Data

Injection-well data furnished to the data-processing equipment are of two types—monthly performance data and permanent well data. Monthly performance data taken from the field work sheet shown in Fig. 2 are punched into IBM cards. These data consist of well number, pressure, last meter reading (cumulative), and days on. Permanent well data are punched into the cards when the water-flood data-processing program is started. Thereafter the machines reuse this stored information each month.

Fig. 3 is a sample IBM form on which the data-processing machines record both water-injection data furnished and the analytical data computed from them. Shaded columns on this and the other IBM forms shown contain data furnished to the machines. The uniformly spaced dot pattern indicates permanent data punched into cards. The irregular pattern indicates data furnished each month for processing. Columns not shaded are computed by the machines. Headings

WATER INJECTION DATA

HARRINGTON BLOCK 17 9 1958

| WELL NUMBER | STATUS | COMPLETION | TREATMENT | | | | DAYS FT. OF FORMATION | ACRE FT. OF FORMATION | WATER INPUT BBL. CUMULATIVE | WATER INPUT BBL. MONTHLY | WATER INPUT BBL. DAILY | AVG. WELL HEAD PRESS. PSI | BBL./DAY PER ACRE FT. | DAYS ON TOTAL NO. | DAYS ON CUMUL. | INJECTIVITY FACTOR | CUMULATIVE INPUT BBL./AC. FT. | CUMULATIVE INPUT % OF FILL UP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| W1 | I | X | | | | | 32.6 | 293 | 431,395 | 11,044 | 368 | 630 | 1.26 | 30 | 1263 | .31 | 1472 | 421 |
| W2 | I | X | | | | | 16.6 | 148 | 288,214 | 7,699 | 257 | 550 | 1.74 | 30 | 1277 | .30 | 1947 | 556 |
| W3 | I | X | 1 | | | | 8.6 | 127 | 293,695 | 7,836 | 261 | 550 | 2.06 | 30 | 1285 | 10.30 | 2312 | 661 |
| W4 | I | X | | | | | 25.6 | 294 | 363,256 | 8,079 | 269 | 530 | 1.06 | 30 | 1295 | .51 | 1430 | 409 |
| W5 | I | X | 1 | | | | 20.3 | 190 | 231,012 | 7,636 | 255 | 615 | 1.34 | 30 | 1237 | .23 | 1215 | 347 |
| W6 | I | X | 1 | | | | 25.3 | 228 | 255,335 | 5,591 | 186 | 780 | .82 | 30 | 1258 | .15 | 1119 | 320 |
| W7 | I | X | 1 | | | | 17.5 | 175 | 219,043 | 5,458 | 182 | 625 | 1.04 | 30 | 1274 | .16 | 1251 | 357 |
| W8 | I | X | 1 | | | | 30.7 | 289 | 233,102 | 870 | 29 | 725 | .10 | 30 | 1280 | .01 | 806 | 246 |
| W10 | I | X | | | | | 47.8 | 478 | 674,342 | 13,646 | 455 | 690 | .95 | 30 | 1294 | .14 | 1410 | 403 |
| W11 | I | X | | | | | 51.4 | 485 | 556,825 | 14,504 | 483 | 680 | 1.00 | 30 | 1272 | .15 | 1148 | 328 |
| W12 | I | X | | | | | 42.4 | 397 | 423,116 | 10,818 | 361 | 650 | .91 | 30 | 1285 | .26 | 1065 | 304 |
| W13 | I | X | | | | | 26.0 | 278 | 318,249 | 7,391 | 246 | 600 | .88 | 30 | 1300 | .28 | 1144 | 327 |
| W14 | I | X | | | | | 33.2 | 293 | 368,418 | 9,361 | 312 | 680 | 1.06 | 30 | 1287 | .15 | 1257 | 359 |
| W15 | I | X | | | | | 35.5 | 316 | 402,349 | 10,757 | 359 | 660 | 1.14 | 30 | 1298 | .24 | 1273 | 364 |
| W16 | I | X | | | | | 26.2 | 281 | 297,011 | 7,344 | 245 | 640 | .87 | 30 | 1288 | .23 | 1056 | 302 |
| W17 | I | X | | | | | 25.3 | 264 | 311,599 | 7,061 | 235 | 519 | .89 | 30 | 1285 | .26 | 1180 | 337 |
| W20 | I | X | | | | | 35.9 | 356 | 456,770 | 10,593 | 353 | 600 | .99 | 30 | 1297 | .14 | 1283 | 367 |
| W21 | I | X | | | | | 34.8 | 346 | 392,055 | 8,207 | 328 | 395 | .95 | 25 | 1295 | .25 | 1133 | 324 |
| W22 | I | X | | | | | 39.7 | 356 | 449,838 | 11,286 | 376 | 550 | 1.05 | 30 | 1267 | .24 | 1256 | 359 |
| W23 | I | X | | | | | 39.7 | 353 | 322,065 | 6,788 | 226 | 640 | .67 | 30 | 1268 | .08 | 959 | 273 |
| W24 | I | X | | | | | 44.0 | 391 | 485,749 | 12,330 | 411 | 560 | 1.05 | 30 | 1284 | .20 | 1191 | 340 |
| W25 | I | X | | | | | 34.2 | 346 | 401,170 | 10,015 | 334 | 690 | .97 | 30 | 1301 | .14 | 1159 | 331 |
| W26 | I | X | | | | | 35.3 | 356 | 343,647 | 10,948 | 365 | 610 | 1.03 | 30 | 1009 | .24 | 965 | 275 |
| W30 | I | X | | | | | 24.2 | 274 | 304,209 | 6,488 | 216 | 650 | .79 | 30 | 1303 | .20 | 1110 | 317 |
| W31 | I | X | | | | | 31.7 | 309 | 381,428 | 8,368 | 279 | 690 | .90 | 30 | 1285 | .16 | 1234 | 353 |
| W32 | I | X | | | | | 41.0 | 276 | 393,695 | 4,239 | 141 | 710 | .51 | 30 | 1264 | | 1426 | 407 |
| W33 | I | X | | | | | 35.4 | 312 | 399,048 | 8,401 | 280 | 610 | .90 | 30 | 1286 | .17 | 1279 | 365 |
| W34 | I | X | | | | | 38.6 | 366 | 460,764 | 5,983 | 199 | 700 | .54 | 30 | 1299 | .13 | 1258 | 359 |
| W40 | I | X | 1 | | | | 8.2 | 106 | 21,261 | 3,863 | 129 | 750 | 1.22 | 30 | 830 | 11.30 | 200 | 57 |
| W41 | I | X | | | | | 14.2 | 168 | 217,986 | 7,965 | 265 | 690 | 1.58 | 30 | 833 | 1.79 | 1297 | 371 |
| W42 | I | X | | | | | 26.8 | 263 | 342,691 | 12,855 | 429 | 610 | 1.63 | 30 | 824 | .39 | 1303 | 372 |
| W43 | I | X | | | | | 27.3 | 272 | 386,925 | 14,580 | 486 | 600 | 1.79 | 30 | 823 | .36 | 1422 | 406 |
| W49 | I | X | 1 | | | | 29.2 | 222 | 348,006 | 7,356 | 245 | 680 | 1.10 | 30 | 1067 | .11 | 1567 | 448 |
| W08 | I | X | | | | | 21.5 | 118 | 145,436 | 3,738 | 125 | 710 | 1.06 | 30 | 741 | | 1402 | 401 |
| | | | | | | | | | 11,919,692 | 289,086 | 9,690 | | | | | | | |

STATUS
F - FLOWING
P - PUMPING
I - INJECTING
S - SHUT IN
T - TEMPORARILY ABANDONED
A - ABANDONED PERMANENTLY
X - OUTSIDE OPERATED

COMPLETION
X - OPEN HOLE
O - LESS THAN ONE PERFORATION PER FT.
1-6 - PERFORATIONS PER FT.
9 - COMBINATION OPEN HOLE & PERFORATED

INJECTIVITY FACTOR:
DEFINED AS B/D OF WATER INJECTED PER MO.-FT. PER 1000 P.S.I. PRESSURE AT THE SAND FACE.

| 9,636 | 785 |
|---|---|
| AVERAGE FOR MONTH | AVERAGE PLANT PRESS. |

**WATER-INJECTION DATA** and machine computed analytical data is recorded on a form of this type. Fig. 3.

EARLOUGHER ENGINEERING
PRODUCTION DATA

COMPANY NO. ____(1-2) MONTH_____

LEASE NO. ____(3-4) PAGE NO.____

| (5-9) WELL NO. | (10-13) DATE | (14-16) OIL | (17-20) WATER |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

OIL PRODUCTION (LEASE) _____

WATER PRODUCTION (LEASE) _____

**FIELD WORK SHEET** for recording monthly production data. Fig. 4.

explain the nature of the information in each column. Symbols used in status and completion columns are explained in footnotes at the bottom of the form. Information furnished to the machines and recorded on this form includes:

1. Well number.
2. Status—whether injecting, shut in, temporarily abandoned, abandoned permanently, or outside operated.
3. Completion—whether open hole or casing set through, cemented and perforated with less than one perforation per foot, one to six perforations per foot, or a combination of open hole and perforated.
4. Treatment—whether the well was shot, acidized, fractured, or broken down with water pressure. The figure in each column gives number of times well was so treated.
5. Net feet of formation—total net sand section, including both overlying gas or underlying water sands, even though the upper or lower parts of the sand section may be cemented off behind tubing or casing.
6. Acre-feet of formation served by the well.
7. Cumulative water input.
8. Average wellhead pressure (psi.) this month.
9. Days on this month.

The data-processing equipment computes data in the unshaded columns from the information furnished. These data developed by the machines include:

- Water input, monthly barrels.
- Water input, daily barrels.
- Barrels per day per acre-foot.
- Cumulative days on.
- Injectivity factor—barrels per day of water injected per millidarcy-foot per 1,000-psi. sand-face pressure.[1]
- Cumulative input, barrels per acre-foot.
- Cumulative input, per cent of fillup.

### Production-Well Data

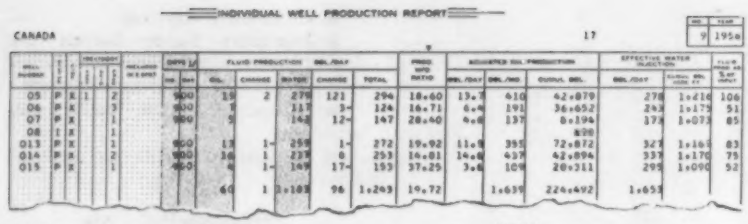
Oil-well production data are handled in a similar manner. Monthly field production data are obtained on the form shown in Fig. 4. This sheet shows well number, date of well test, oil and water produced on test, and, at the bottom of the page, actual barrels of oil and water production for the entire lease.

The individual well-production report shown in Fig. 5 is an IBM form on which the data-processing equipment records both source data and computed data. Data on this form that are furnished to the machines include:

1. Well number.
2. Status—whether flowing, pumping, injecting, shut in, temporarily abandoned, or abandoned permanently.
3. Completion.
4. Treatment.
5. Included in five-spot-used to designate additional oil wells located within the five-spot identified by this well number.
6. Date—month and day of well tests.
7. Test oil production, barrels per day.
8. Test water production, barrels per day.

Data computed by processing equipment from the data just listed include:

- Change in oil production from last month.
- Change in water production from last month.
- Total fluid production, barrels per day.
- Produced water-oil ratio.
- Adjusted oil production, barrels per day. This adjusted figure reconciles production figures based on well tests with actual production figures for the month (oil run to the pipeline, corrected for stock on hand at the first and last of the month).
- Adjusted oil production, barrels per month.
- Adjusted oil production, cumulative barrels.
- Effective water injection, barrels per day.
- Effective water injection, cumulative barrels per acre-foot (one-fourth of cumulative water injected by each of the four surrounding input wells).
- Produced fluid as per cent of input for each five-spot.


INDIVIDUAL WELL PRODUCTION REPORT

CANADA 17 9 1956

| WELL NUMBER | TYPE | | | | | DATE OF | FLUID PRODUCTION BBL./DAY | | | | | PRESS. INTO RATIO | ADJUSTED OIL PRODUCTION | | | EFFECTIVE WATER INJECTION | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | OIL | CHANGE | WATER | CHANGE | TOTAL | | BBL./DAY | BBL./MO. | CUMUL. BBL. | BBL./DAY | | |
| 05 | P | X | 1 | 2 | | 900 | 18 | 2 | 279 | 121 | 294 | 18.60 | 13.5 | 610 | 42,879 | 278 | 1,416 | 106 |
| 06 | P | X | | 3 | | 830 | 1 | | 117 | 3- | 124 | 16.71 | 6.4 | 191 | 36,652 | 243 | 1,175 | 91 |
| 07 | P | X | | 1 | | 980 | 5 | | 142 | 12- | 147 | 28.40 | 4.6 | 137 | 8,194 | 178 | 1,073 | 85 |
| 08 | I | X | | 1 | | | | | | | | | | | 8,298 | | | |
| 013 | P | X | | 2 | | 900 | 13 | 1- | 259 | 1- | 272 | 19.92 | 11.5 | 395 | 72,872 | 347 | 1,161 | 83 |
| 014 | P | X | | 2 | | 1000 | 14 | 1 | 239 | 0 | 253 | 16.81 | 14.6 | 437 | 42,894 | 337 | 1,170 | 79 |
| 015 | P | X | | 1 | | 960 | 6 | 1- | 149 | 17- | 155 | 37.25 | 3.6 | 109 | 28,311 | 295 | 1,090 | 52 |
| | | | | | | | 60 | 1 | 1,103 | 96 | 1,203 | 19.72 | | 1,639 | 224,492 | 1,653 | | |

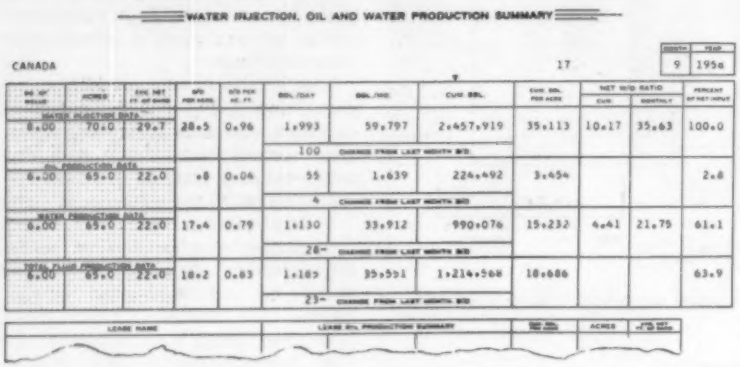
STATUS
F - FLOWING
P - PUMPING
I - INJECTING
S - SHUT IN
T - TEMPORARILY ABANDONED
A - ABANDONED PERMANENTLY
X - OUTSIDE OPERATED

COMPLETION
X - OPEN HOLE
O - LESS THAN ONE PERFORATION PER FT.
6 - PERFORATIONS PER FT.
9 - COMBINATION OPEN HOLE & PERFORATED

IF NO DAY IS GIVEN, DATA SHOWN ARE AVERAGES OF TWO OR MORE TESTS.

ACTUAL OIL PROD. BBL./DAY: 55
ACTUAL WATER PROD. BBL./DAY: 1130
CHARGEABLE TO LEASE: 341
LEASE TOTAL: 1,994

**IBM** form on which data-processing equipment records both source data and computed results for individual wells. Fig. 5.


WATER INJECTION, OIL AND WATER PRODUCTION SUMMARY

CANADA 17 9 1956

| NO. OF WELLS | ACRES | AVG. NET FT. OF SAND | BBL. PER ACRE FT. | BBL./DAY | BBL./MO. | CUM. BBL. | CUM. BBL. PER ACRE | NET W/O RATIO CUM. | NET W/O RATIO MONTHLY | PERCENT OF NET INPUT |
|---|---|---|---|---|---|---|---|---|---|---|
| WATER INJECTION DATA | | | | | | | | | | |
| 8.00 | 70.0 | 29.7 | 28.5 | 0.96 | 1,993 | 59,797 | 2,457,919 | 35,113 | 10.17 | 35.63 | 100.0 |
| | | | | | 100 CHANGE FROM LAST MONTH BID | | | | | | |
| OIL PRODUCTION DATA | | | | | | | | | | | |
| 6.00 | 65.0 | 22.0 | .8 | 0.04 | 55 | 1,639 | 224,492 | 3,454 | | | 2.8 |
| | | | | | 4 CHANGE FROM LAST MONTH BID | | | | | | |
| WATER PRODUCTION DATA | | | | | | | | | | | |
| 6.00 | 65.0 | 22.0 | 17.4 | 0.79 | 1,130 | 33,912 | 990,076 | 15,232 | 4.41 | 21.79 | 61.1 |
| | | | | | 28- CHANGE FROM LAST MONTH BID | | | | | | |
| TOTAL FLUID PRODUCTION DATA | | | | | | | | | | | |
| 6.00 | 65.0 | 22.0 | 18.2 | 0.83 | 1,185 | 35,551 | 1,214,568 | 18,686 | | | 63.9 |
| | | | | | 23- CHANGE FROM LAST MONTH BID | | | | | | |

| LEASE NAME | LEASE OIL PRODUCTION SUMMARY | | | | | NO. WELLS | ACRES | AVG. NET FT. OF SAND |
|---|---|---|---|---|---|---|---|---|

**MONTHLY** production-injection summary for each lease. Fig. 6.

### Water-Injection Sheet

Fig. 6, the water injection, oil, and water production summary, summarizes all monthly data for individual leases. This form is also used, as in Fig. 7, to summarize data on an entire water-flood project.

The upper half of the sheet summarizes data on water injection, oil production, water production, and total fluid production. The first three columns give the number of wells, the number of acres included, and average net feet of sand. The next six columns show injection and production data in terms of barrels per day per acre, barrels per day per acre-foot, barrels per day, barrels per month, cumulative barrels, and cumulative barrels per acre. The last three columns give the net water-oil ratio (water injected as barrels per day per acre divided by oil produced as barrels per day per acre), both cumulative and monthly, and the per cent of net input represented by current injection and production figures on a per-acre basis.

The bottom half of this form shows oil-production data for each individual lease in the water flood in terms of barrels per day, barrels per month, cumulative barrels, and cumulative barrels per acre. It also shows the number of acres in each lease and the average net feet of sand.

**Water-injection data . . .** The use and value of most of the data computed by data-processing machines are readily apparent. Some of these data are especially valuable. For example, in Fig. 3, water-injection data, the column giving unit injection in terms of barrels per day per acre-foot is helpful because it indicates the uniformity or nonuniformity of an individual injection well's performance.

The two columns that present cumulative input as barrels per acre-foot and as per cent of calculated fillup are particularly useful in the early life of a flood. When ample core analysis data are available, the amount of injected water required for 100% fillup can be calculated fairly accurately. By knowing the approximate degree of fillup each month, an engineer knows when fluid production should be increasing and how large the increase should be.

These cumulative input columns also help determine whether the bore of a producing well is damaged. For example, if a number of injection wells are approaching 100% fillup, fluid production from the offset producing wells should be approaching 100% of the injection rate. If fluid production has not increased properly, the production wells affected probably need some kind of well-bore stimulation such as cleaning out, fracturing, or acidizing.

The column on this sheet which presents each well's injectivity factor for the month is also helpful. Injectivity factor is defined as barrels of water injected per day per millidarcy-foot per 1,000-psi. sand-face pressure.

The injectivity factor is a good indicator of an injection well's performance.[1] Too great a departure from a normal value generally indicates need for a remedial treatment. If the factor is too low, either a clean-out or a fracturing treatment is usually needed. If the factor is too high, some type of selective plugging may be indicated. However, a very high value may result from a thin, tight, localized sand condition, as exhibited by well W-3, Fig. 3.

**Fluid-production data . . .** The last two columns in the individual well-production report (Fig. 5) are especially valuable in analyzing individual well performance and in determining when production wells need remedial treatments. Data in the next-to-the-last column, theoretical effective water injection as cumulative barrels per acre-foot, readily relate injection-well status to individual producing wells.

After fillup is attained, data in the last column—fluid production as per cent of input—are valuable in indicating well-bore damage in producing wells. Workovers or stimulation treatments can then be planned to eliminate well-bore restrictions.

Plotting production-well data and over-all water-flood project data on performance is necessary to follow performance trends. Such curves are especially valuable for rapidly reviewing past performance history. Although performance curves are usually hand-plotted each month, the IBM 407 tabulator can be adapted to plot these curves from data already in the cards.

**Individual-well case history . . .** Fig. 8 is a performance curve which illustrates the value of machine-processed data in determining when to stimulate a water-flood production well to obtain maximum oil production. This well is part of the flood shown in Fig. 1.

Water injection into this five-spot well began in July 1955. By May 1956, cumulative water injection equaled the calculated fillup volume. However, total fluid produced was only 20 bbl. per day, or less than 10% of the water-injection rate. This indicated that well-bore restrictions were blocking flow channels and reducing production. Therefore, the well was fractured late in May 1956. Production during the next 4 months indicated that fillup had been reached, inasmuch as the total fluid-production

WATER INJECTION, OIL AND WATER PRODUCTION SUMMARY

HARRINGTON BLOCK — 17 — MONTH 9 — YEAR 1958

| NO. OF WELLS | ACRES | NET FT. OF SAND | B/D PER ACRE | B/D PER AC. FT. | BBL./DAY | BBL./MO. | CUM. BBL. | CUM. BBL. PER ACRE | NET W/O RATIO CUM. | NET W/O RATIO MONTHLY | PERCENT OF NET INPUT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| WATER INJECTION DATA | | | | | | | | | | | |
| 30.00 | 300.0 | 30.4 | 27.3 | 0.90 | 8,193 | 249,799 | 10,249,418 | 34,165 | 12.57 | 39.00 | 100.0 |
| | | | | | 477 | CHANGE FROM LAST MONTH B/D | | | | | |
| OIL PRODUCTION DATA | | | | | | | | | | | |
| 28.00 | 267.5 | 20.8 | .7 | 0.03 | 188 | 5,648 | 727,408 | 2,719 | | | 2.6 |
| | | | | | 16 | CHANGE FROM LAST MONTH B/D | | | | | |
| WATER PRODUCTION DATA | | | | | | | | | | | |
| 28.00 | 267.5 | 20.8 | 26.4 | 1.27 | 7,049 | 211,482 | 5,813,368 | 21,732 | 7.99 | 37.71 | 96.7 |
| | | | | | 37- | CHANGE FROM LAST MONTH B/D | | | | | |
| TOTAL FLUID PRODUCTION DATA | | | | | | | | | | | |
| 28.00 | 267.5 | 20.8 | 27.1 | 1.30 | 7,238 | 217,130 | 6,540,776 | 24,451 | | | 99.3 |
| | | | | | 20- | CHANGE FROM LAST MONTH B/D | | | | | |

| LEASE NAME | LEASE OIL PRODUCTION SUMMARY | | | TOP ALLOW. FOR MONTH | ACRES | ALLOW. PER ACRE |
|---|---|---|---|---|---|---|
| ALWELL | 46 | 1,390 | 192,646 | 3,350 | 37.5 | 25.5 |
| CANADA | 55 | 1,639 | 224,492 | 3,454 | 65.0 | 22.0 |
| HAMPTON | 32 | 895 | 36,332 | 1,321 | 27.5 | 12.6 |
| SHATTUCK | 57 | 1,724 | 273,940 | 2,331 | 117.5 | 10.7 |

**THIS FORM**, similar to Fig. 6, can be used to summarize the injection-production data for an entire field. Fig. 7.

rate from June through September was actually more than the theoretical injection rate. As a result of the fracturing job, oil production increased from 9 bbl. per day to nearly 150 bbl. per day. By October, oil production had dropped to 55 bbl. per day; and by January, 1957, it had decreased to only 40 bbl. per day. Total fluid production dropped from 365 bbl. per day in June to about 110 bbl. per day in January.

However, the injection rate into the five-spot remained satisfactory. Apparently well-bore plugging, probably resulting from scale deposition in the sand,[2] caused the decreased fluid-production rate.

The well was fractured again in March 1957. Gross fluid production immediately increased to about 100% of the effective water-injection rate and oil production increased from 36 bbl. per day in February to 60 bbl. per day in April. The approximate amount of additional oil produced as a result of this second fracturing treatment from April 1957, through November 1958 (10,400 bbl.) is represented by the shaded area between the extrapolated decline curve and the curve representing actual oil production during this period.

**Water-flood case history . . .** Performance of the entire water-flood project is shown in Fig. 9. Machine-processed data were used to determine the fillup point for each well in this flood. Fracturing treatments on new oil wells were then scheduled to coincide with the time of calculated fillup.

This planned stimulation program, based on using machine-processed data to analyze flood performance, resulted in peak oil production for this flood in October 1956. At this point, total oil and water production actually equaled the water-injection rate on a barrels per acre basis.

Based on operating and development costs in 1955, the 7-year operating life that would have resulted by following customary water-flood practices in this area would have made this flood unprofitable. However, data-processing equipment provided detailed analytical data each month on

**"Plotting production-well data and over-all water-flood project data on performance is necessary to follow performance trends. Such curves are especially valuable for reviewing past performance history."**

the fillup status of each five-spot as related to production and injection rates. As a result, well-bore restrictions were discovered and corrected quickly. Thus the operator obtained full recovery from this water flood in only 4 years. As a result, what otherwise would have been a break-even proposition became an economic and profitable operation.

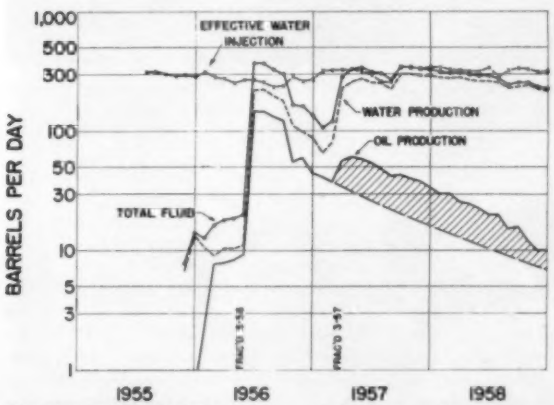
**Cost of machine-processed data . . .** Many organizations are equipped to handle data processing efficiently. Initial setup cost of a water-flood project for data processing, including engineering and programing for the data-processing equipment, usually ranges from $2 to $3 per well. After such a system is begun, monthly costs usually range from 40 to 70 cents per well, depending upon the size of the project.


### Acknowledgment

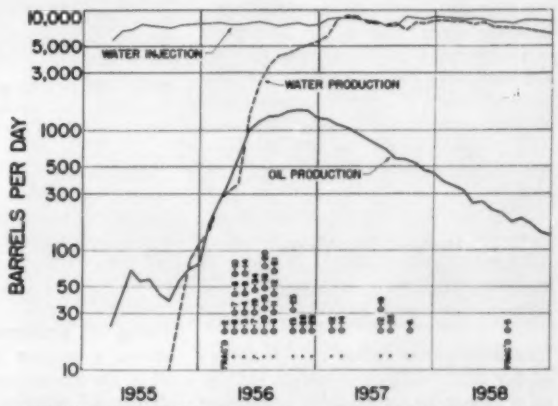
The author wishes to express his appreciation to the Winona Oil Co. of Delaware for permission to publish water-flood data included in this paper.


### References


1. Earlougher, R. C., "Prediction of Water-Injection Rates from Permeability Data," presented at AIME spring meeting, Mar. 20-21, 1958, Tulsa.
2. Earlougher, R. C., and Love, W. W., "Sequestering Agents for Prevention of Scale Deposition in Oil Wells," presented at Permian basin oil-recovery conference, Apr. 18-19, 1957, Midland, Tex.


**PERFORMANCE CURVE** for an individual well may be studied to determine correct time to use stimulation techniques. Fig. 8.




**PERFORMANCE CURVE** for entire water-flood project. Machine-processed data were used to plan the well-stimulation program shown along bottom of figure. Fig. 9.

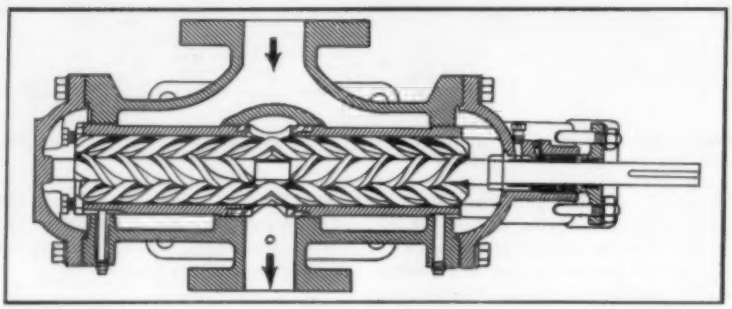
FIELD PROCESSING

# Save power; boost profits

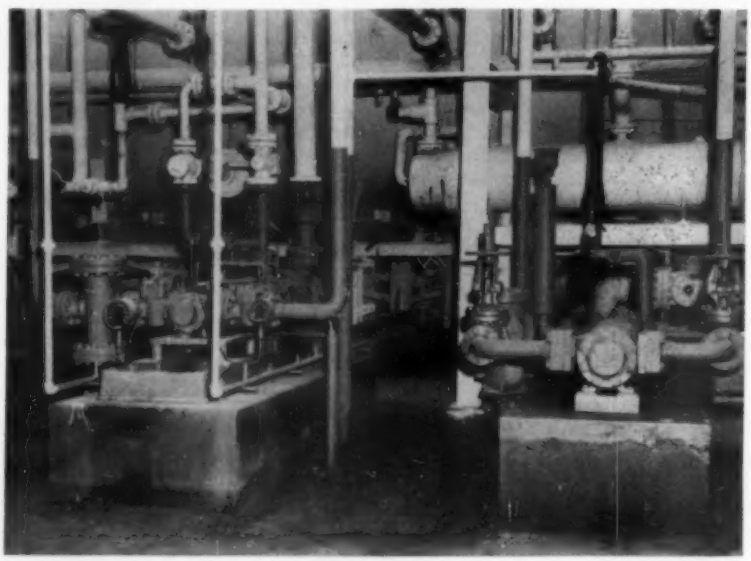
## La Gloria did it with a program of horsepower conservation

AN ALL-OUT EFFORT to utilize wasted power and thus improve process efficiency is being made by the Falfurrias, Tex., plant of La Gloria Oil & Gas Co. Such wasted power is seen in the high-temperature gases escaping from boiler or heater stacks, and in the exhaust gases from internal-combustion engines.

Improving power factors in electrical power systems, and utilizing exhaust steam in low-pressure turbines, offer possibilities for waste power recovery. The pressure drop wasted in fluids flowing through pressure reducing valves can be converted to a source of power.



**IMO PUMP** is used as a driver in utilizing pressure drop in liquid streams. It is a constant-displacement, rotary, meshing helical screw-type pump. Two outer rotors are idlers rolling on center or power rotor. Fig. 1.



**INLET OIL** at 600 psig. drives motor at left. This in turn develops 37 hp., pumping lean oil. Motor at right develops 50 hp. and is direct-connected at instrument air compressor. Fig. 2.

**Gas-driven pump . . .** Due to process changes, it became necessary to relocate a 55-hp. steam-turbine-driven water pump. In its new location estimated costs of supply and exhaust piping favored gas piping over steam piping. Our 50-psig. fuel-gas system was drawing its gas from a 300-psig. supply through a pressure-reducing valve. Since the turbine case had been designed for 250-psig. inlet steam pressure, a pressure-control valve was necessary to maintain this pressure at the turbine inlet.

Parts to convert the turbine from steam to gas operation cost $260. Taking these costs into consideration, installation costs for either gas or steam operation were considered about equal.

Using the turbine manufacturer's data on water rate if the unit were to be operated steam driven, and his estimate on gas leakage from the packing cases if operated gas driven, an operating-cost comparison was made. The result favored the gas-driven operation by 14 cents per hour, or $100 per month.

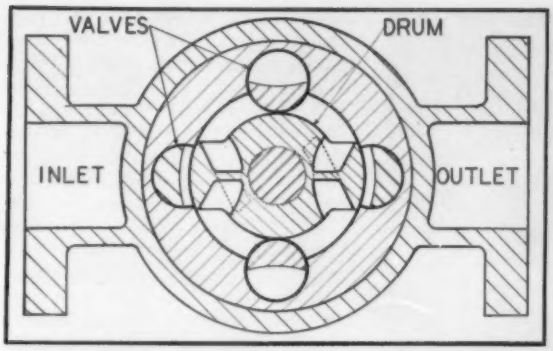
This was our first gas expanding turbine. It has now been operating for over 4 years with a minimum of maintenance, and a savings in operational cost of over $5,000.

**Increased power factor . . .** A survey of our electrical power system indicated a power factor of 0.67. At a cost of $1,750 we installed twelve 15-kvap., 440-volt, 3-phase capacitors, and raised this power factor to 0.80. With a generating plant rated at 1,125 kva. this represented an increase in available power of 164 kw. or 220 hp.

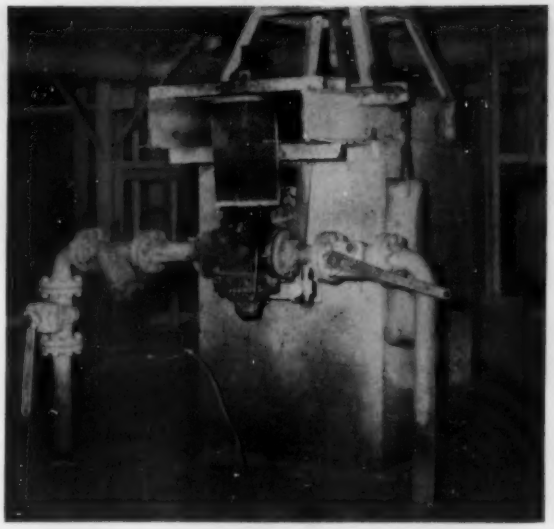
Presented at NGAA Gulf Coast regional meeting, Corpus Christi.

BY E. W. FITCH
La Gloria Oil & Gas Co.

**Using oil pressure drop . . .** Fig. 1 shows a section through one design of a De Laval-Imo pump, used as a driver in utilizing pressure drop in liquid streams. It is a constant-displacement, rotary, meshing helical screw-type pump. The two outer screws or rotors are idlers rolling on the center or power rotor. Rotating in an opposite direction from the power rotor, and driven by fluid pressure, they serve as sealing elements. With the power rotor they are the only three moving parts in the pump or motor. Fluid flow is axial from




**ANOTHER SUITABLE PUMP** is the positive-displacement, rotating-valve type. Rotating valves alternately cover and uncover ports in the rotor. Fig. 3.



**AIR-COOLED CONDENSER FANS** are driven by the rotating-valve pump. Maximum horsepower is 21; rich oil is reduced from 600 to 330 psig. Fig. 4.

both ends to the center, providing hydraulic and dynamic balance.

Fig. 2 shows an installation at left where a motor uses 600-psig. inlet oil to drive a direct-connected lean-oil pump, and developing about 37 b.hp. For 21 months daily records were kept of speed, flow, and differential pressure across both pump and motor. These records indicated a motor efficiency of 75 to 80%. With this design we have never had any mechanical trouble. Speed control is by hand setting of the outlet valve.

The motor at right in Fig. 2 is the same design, but a larger size developing 50 b.hp. It is direct-connected to a Nash air compressor which will be used to supply plant instrument air. At present we are using gas in our instrument system. Although this unit has not yet been put into service, we anticipate no difficulty with the driver.

**Rotating valve pump . . .** Another design we are using is shown in Fig. 3. It is a positive-displacement, rotating-valve type. The rotating valves alternately cover and uncover ports in the rotor, the ports passing by the inlet and outlet channels. The fluid thus flows into and out of the chamber areas turning the rotor. This is a close-clearance machine, and the rotating valves are gear driven from the rotor shaft.

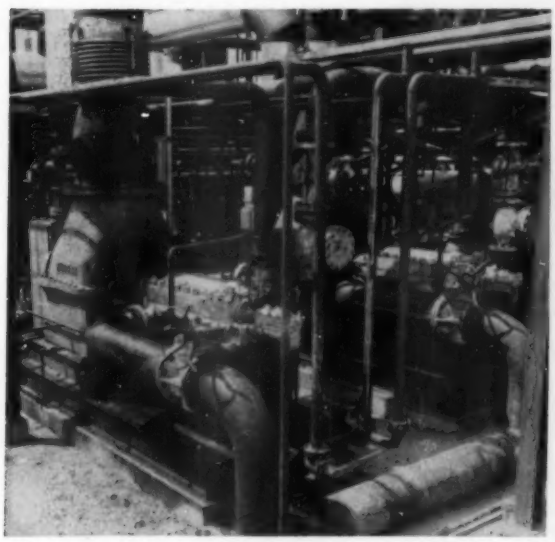
Initially we tried this design operating at 1,750 r.p.m. through a gear reducer to a 265-r.p.m. fan, with rich oil from 1,100 psig. to 800 psig. We had trouble with the motor locking. Presently we are operating two such units at 500 to 750 r.p.m. belt-driving fans on air-cooled condensers. This installation is shown in Fig. 4. Maximum horsepower at 750 r.p.m. is 21. Inlet rich oil is at a pressure of 600 psig. and outlet at a pressure of 330 psig. Speed is hand controlled by the outlet valve.

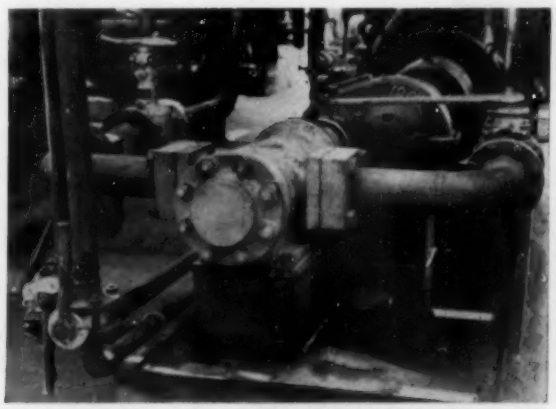
We have had some trouble with breakage and wear of the moving parts, and with leaking seals. However, replacement parts are giving better service, and these motors have been in operation for almost 3 years.

### New Absorption Unit

About a year ago, La Gloria installed an additional absorption unit to increase the recovery of ethane, propane, and butane. Process design called for an absorption oil-to-gas ratio of 25 gal. per M.c.f. After absorption at 1,150, 1,000, or 600 psig., the rich oil is flashed successively at 500, 105, 35, and 0 psig., and then delivered to a 5-psia. dry stripper.

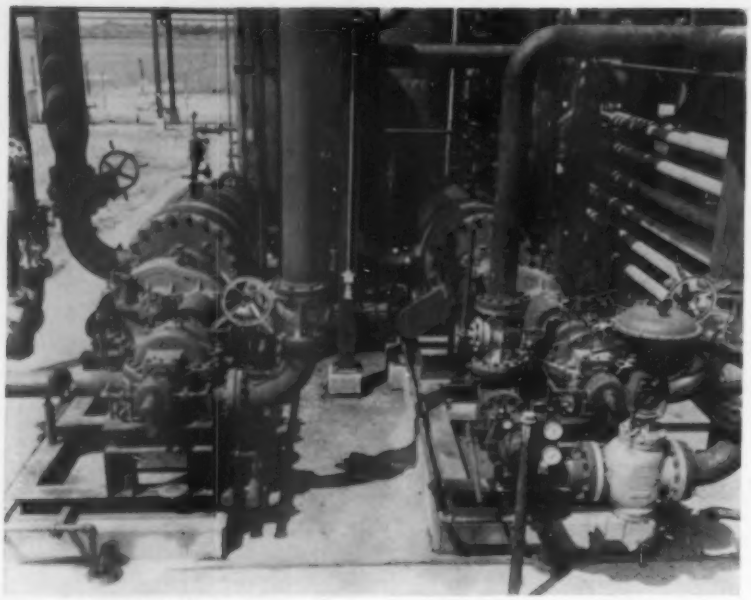
The 35 and 0-psig. flash gases, along with the vacuum stripper overhead product, are compressed as product gases to a 400-psig. reabsorber





**TWO LEAN-OIL BOOSTER PUMPS** take suction from the vacuum stripper. The Imo pump develops 80 hp. for this job, operating on rich oil. Fig. 6.

**EXHAUST STEAM** drives two 1,425-hp., 3,800-r.p.m. turbines for pumping lean oil. Fig. 5.



**OVERHEAD PRODUCT GAS** from the vacuum stripper is compressed to 0 psig. by this unit. Rich oil is used as source of power. Fig. 7.

where the propane and butane are recovered. The ethane-rich overhead gas from this reabsorber is delivered to a pipeline as feed to a chemical plant.

Power for the compression of plant reabsorber overhead feed gas to the unit, for the recompression of flash gases within the unit, and the compression of product gases to the reabsorber are handled by gas-fueled internal-combustion drivers. The new compression facilities installed are two 1,500-hp. units.

There still remain about 4,000 hp., almost 50% of the total required for the unit, to be supplied to pumps, fans, and compressors. The existing high-pressure steam and electrical power systems could not furnish this demand. And we were able to make out without any further installation of power-generating equipment.

**Exhaust-steam drive . . .** Of total requirements, 2,850 hp. is for pumping 3,460 g.p.m. of lean oil over the three absorbers. We had available about 100,000 lb. per hour of 7-psig. exhaust steam. We are now using 75,000 lb. per hour of this 7-psig. steam to drive two 1,425-hp., 3,800-r.p.m. turbines in this service.

Turbine exhaust is at 26 in. of vacuum to a new condenser. This enabled us to take out of steam-condensing service an 18-year-old natural-draft cooling tower, along with two air-cooled, fin-tube steam condensers that are now furnishing jacket water cooling for the new 1,500-hp. compressors in the unit. Fig. 5 shows these low-pressure turbines and the oil pumps. An oil relay governor positions a 20-in.-inlet butterfly valve. Overspeed trips, both automatic and manual, act to close this valve. Speed is set with a hand speed changer. Lubrication is forced feed with built-in pump, oil reservoir, and cooler. Low oil pressure in the lubrication system will also act to close the inlet valve.

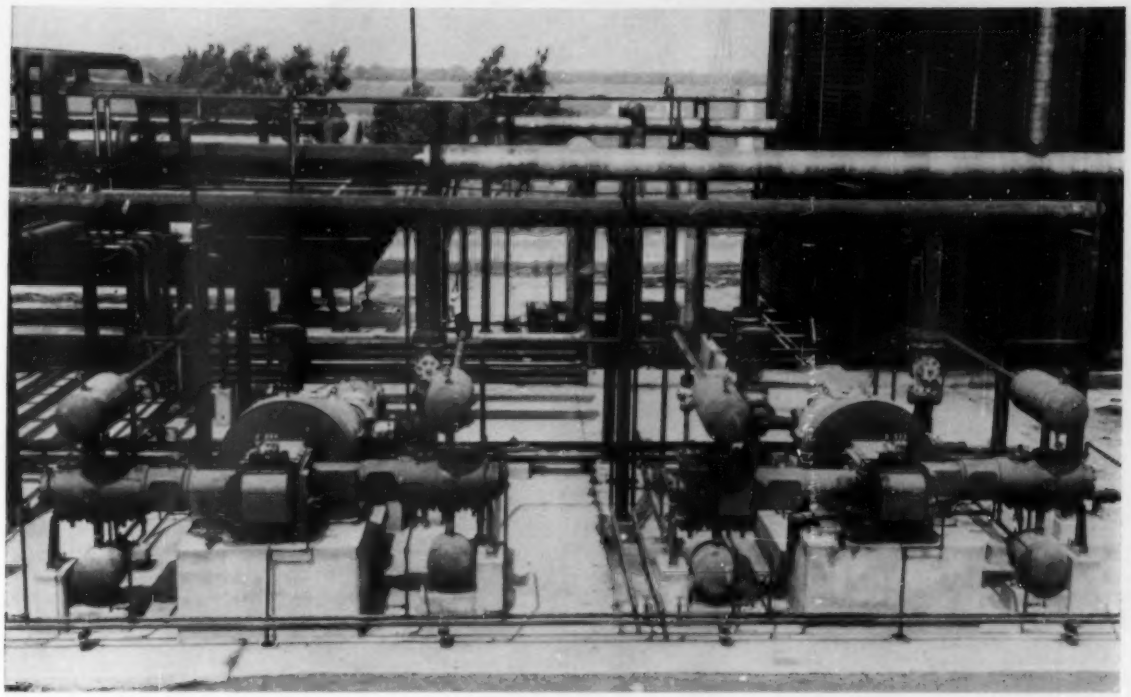
To feed these pumps we employ two booster pumps, requiring 80 hp. each, which take suction from the vacuum stripper. Fig. 6 shows the driver of one of these units again featuring a De Laval-Imo pump. It operates at 3,500 r.p.m. through a gear reducer with a 1,200-r.p.m. output. Rich oil flowing at a rate of 500 g.p.m. from the 500-psig. flash tank to the 105-psig. flash tank is used in each of these two drivers. Speed is hand controlled by the outlet valve.

**Stripper overhead . . .** The vacuum stripper overhead product gas is compressed to 0 psig. and joins the 0-psig. flash tank gas. Fig. 7 shows one of the two units doing this job. The two units require a total of 2,000 g.p.m. of the rich oil from the 500-psig. flash tank, discharging to the 105-psig. flash tank. Thus we have used for power in this rich-oil pressure drop, 3,000 of the 3,460 g.p.m. circulating in the system. The other 460 g.p.m. is used for conventional level control in the 500-psig. flash tank.

The compressors shown are Allis-Chalmers sliding-vane units. Operating speed is 455 r.p.m. and they require 150 b.hp. input each. Driver speed is 3,500 r.p.m. through a gear speed reducer. This driver is a two-stage centrifugal pump. Speed control and shutdown devices are employed. A belt drive from the low-speed shaft activates a speed controller with a pneumatic output. This output positions the motor valve in the oil line to the driver.

There are four pneumatic shutdown signals, each of which operates a separate three-way valve installed in series in the air line to the inlet oil motor valve. They act to vent the diaphragm and shut off the flow of oil. These

**GAS-EXPANDING TURBINES** develop 327 hp. for cooling-tower power requirements. Shown here are the fan drivers, requiring 120 hp. Fig. 8.



**RICH OIL** from absorbers drives gas-compression units. Here is the compressor end of one of the units. Fig. 9.

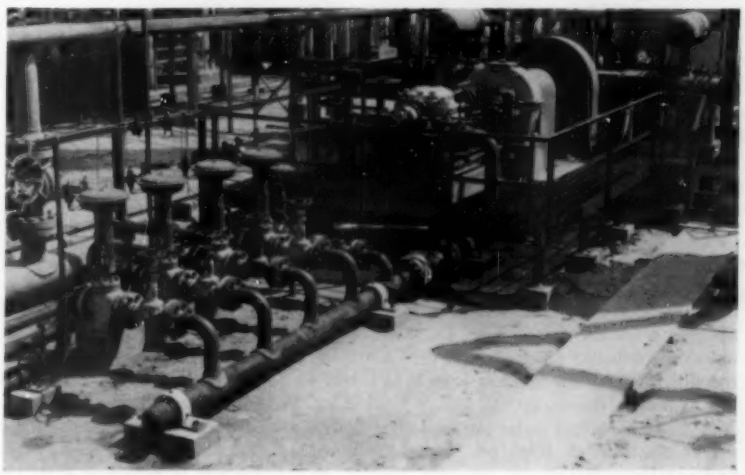
are installed for overspeed, high compressor jacket water temperature, high liquid level in the compressor suction scrubber, and low level in the 500-psig. flash tank.

**Utilizing gas pressure drop . . .** Our 50-psig. fuel system is supplied from a 300-psig. source. Over 18 million cubic feet per day is made up in this manner. The one gas expander described earlier was the only driver operating on this pressure drop, and its consumption was 3.5 million cubic feet per day.

Our new cooling tower required 120 hp. for fan drivers, and 200 hp. for the circulating water pump. Also needed was 5 hp. for a pump to return the condensate from the vacuum steam condenser to the boilers. These jobs are all handled by gas-expanding turbines using 11 million cubic feet per day. The remainder of 4 million cubic feet is made up directly to the fuel system through a regulator for pressure control.

Gas is preheated in an exchanger with 7-psig. exhaust steam to a temperature of 170° F. The condensate pump driver is an old converted steam turbine with inlet pressure controlled at 250 psig. It operates at 3,500 r.p.m. and is direct-connected to the pump. The fan and water-circulating pump drivers are new equipment utilizing the full 300-psig. inlet pressure and turning 4,500 r.p.m.

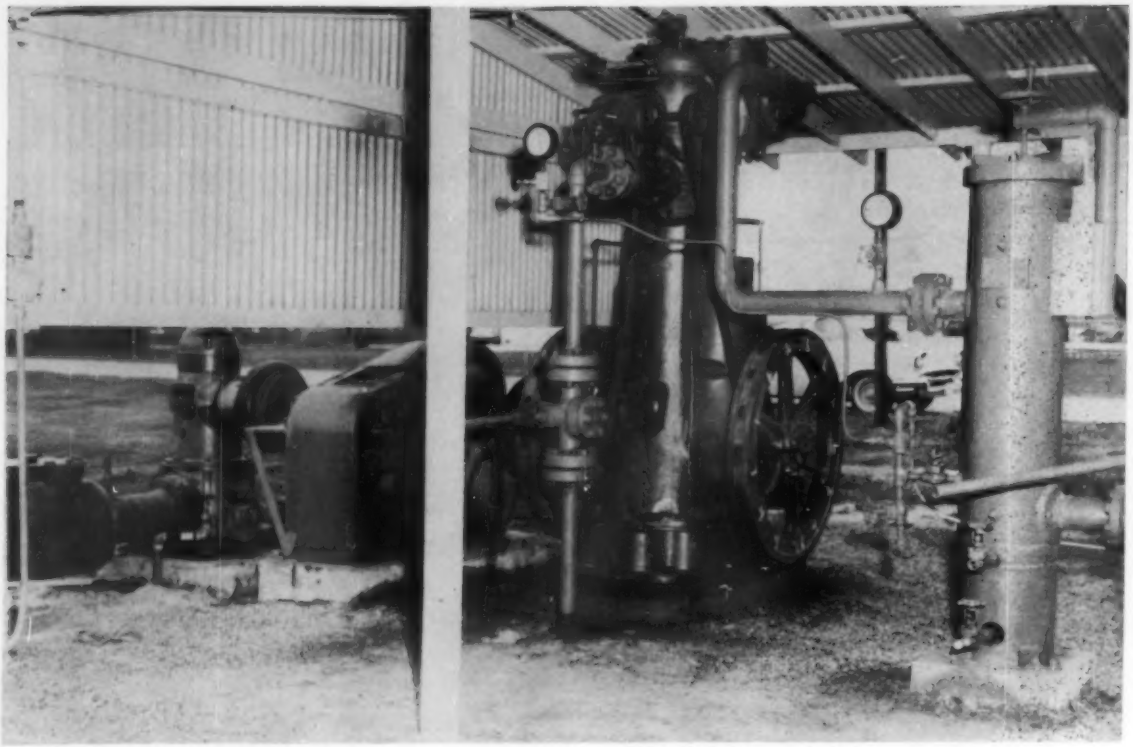
Fig. 8 shows the fan drivers atop the cooling tower. They have integral gears for reducing the 4,500-r.p.m. gas-expander speed to a shaft speed of 1,750 r.p.m. into the fan gear reducer. The water pump drivers have a separate gear reducer to cut the expander speed to a pump speed of 1,200 r.p.m. The gas expanders are all equipped with shaft-type mechanical speed governors, separate overspeed trip valves, and hand speed changers.



**DRIVER END** of rich-oil-driven compressor is shown here. Shaft hp. to each compressor is 300 to 350. Fig. 10.

**High-pressure oil . . .** In the new unit we have a 1,300-g.p.m. stream from both the 1,150-psig. and 1,000-psig. absorbers, dropping to the 500-psig. flash tank. Our four older absorbers furnish 1,500 g.p.m. from 1,150 psig. to a 600-psig. flash tank. This hydraulic horsepower is now harnessed for gas compression.

Fig. 9 shows the compressor end of the two units operating individually on oil from the two absorbers in the new unit. The compressors have two horizontally opposed cylinders, and are rated at 300 b.hp. input at 500 r.p.m. The drivers are all three-stage centrifugal pumps. These are oper-



**PIPELINE GAS** takes a 200-psi. drop through this vertical engine. The unit develops 60 hp. which is used through a series of speed increasers to drive a turbine pump on well water. Fig. 11.

ated from 3,150 to 3,500 r.p.m.

The driver end of the third unit is shown in Fig. 10. This unit is operating on the rich oil from our four older absorbers. Shaft horsepower to these compressors varies, from unit to unit, from 300 to 350 b.hp. depending on oil-pressure drop and oil-flow rate available. On the unit shown here, oil flow from each of the four absorbers passes through an individual control valve controlling level in the absorber. Flow is then joined to the hydraulic driver.

A bypass control valve around the driver controls its inlet oil pressure. Low compressor lube-oil pressure and driver overspeed actuate valves putting full supply air pressure to open the bypass control valve.

Two other units each draw their oil directly from one absorber only, through a motor valve that operates fully open or fully shut. Two motor valves in parallel pass oil directly to the 500-psig. flash tank for absorber level control. If the compressor is running, air pressure from the diaphragm of the fully open oil inlet valve to the driver locks out one of these parallel level control valves.

A manually controlled block valve, on the oil inlet to the compressor driver, is set to prevent the driver oil demand draining the absorber. Driver overspeed or compressor low lube-oil pressure vent pressure from the oil inlet valve and the second level control valve lockout. This closes the oil inlet to the driver, kills the compressor, and opens up the second level control valve to the level controller.

A lower-level snap-acting controller on the absorber will close both level-control valves and the oil-inlet valve to the compressor driver, if the liquid level becomes dangerously low.

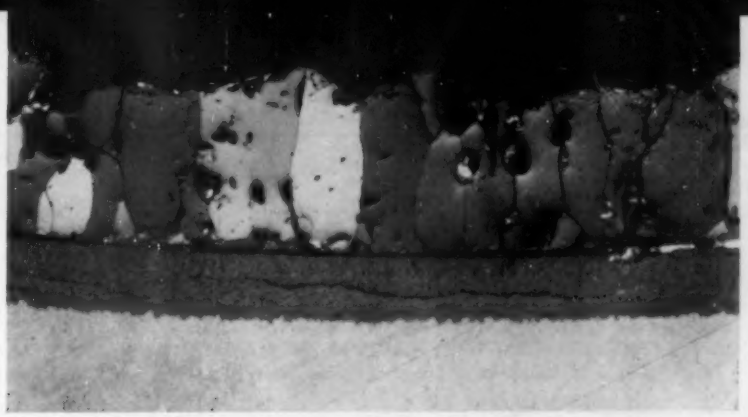
**High-pressure gas . . .** Our pipeline sales gas is dehydrated at a pressure of 1,000 psi., but the major portion of the sale is delivered to the line after a pressure drop of some 200 lb. The cost of a rotary driver, designed for this higher inlet pressure, was excessive. The pressure drop is utilized instead in a reciprocating piston-type steam engine.

The vertical, throttling, piston-valve engine shown in Fig. 11 develops 60 b.hp. at 350 r.p.m. Speed is increased to 585 r.p.m. through a pair of V-belted sheaves, and then to 1,760 r.p.m. in the right-angle gear drive shown at the far left of the figure. Here the power is being used to drive a turbine pump in a plant water well.

To smooth out any shock loading and torsional vibration between the reciprocating driver and its rotating load, two flywheels are mounted on the driver crankshaft and flexible cushion couplings are used for shaft connectors between engine and load. At the inlet to the engine a volume bottle is installed after the governor valve to assure a full supply of gas to the engine cylinder.

**"Maintenance on all this equipment is low—no more than any turbine, rotary pump, centrifugal pump, or electric motor—and far less than an internal-combustion engine. Operating costs are low, there being only lubrication and fluid leakage losses."**

**Low maintenance . . .** Maintenance on all this equipment is low—no more than any turbine, rotary pump, centrifugal pump, or electric motor—and far less than an internal-combustion engine. Operating costs are low, there being only lubrication and fluid leakage losses.




**SULFIDE SCALE** on 12 Cr steel. 0.3 psi. $H_2S$ in $H_2$, 1,050° F., 400 hours, 100X, polarized light. Fig. 8.

BY W. H. SHARP AND E. W. HAYCOCK
Shell Development Co.

Part 1 of this series appeared in the June 1 issue of The Oil and Gas Journal. This installment covered a description of test equipment and procedures, and a discussion of some of the pertinent process variables. This latter subject is concluded here.

# Sulfide scaling under hydrorefining conditions

**SULFIDE SCALE** on pure iron. 75 psi. $H_2S$ in 600 psi. $H_2$, 750° F., 192 hours, 130X, polarized light. Fig. 9.

**PART 2 OF 3 PARTS**

APPRECIABLE reduction of sulfiding rates of low-chromium steels was observed when hydrocarbons were added to the hydrogen sulfide-hydrogen feeds under simulated hydrodesulfurizer conditions (see Fig. 10).

This is in contrast to the lack of influence of one of the same hydrocarbon feeds under Platforming conditions (see Fig. 11).

No firm conclusion was reached regarding the apparent difference in effect of hydrocarbon on sulfiding rates in the two series of runs. Small reductions in corrosion rate might be attributed to such factors as reduction in partial pressure of hydrogen sulfide by the vaporization of hydrocarbon in the 700° F runs, restriction of access of hydrogen sulfide by the liquid film on the metal at the lower temperature, or buildup of a carbonaceous residue on the metal.

None of these possibilities appear to explain all the data adequately. Further investigation of the effect of hydrocarbons at low temperatures is required before definite conclusions can be drawn.

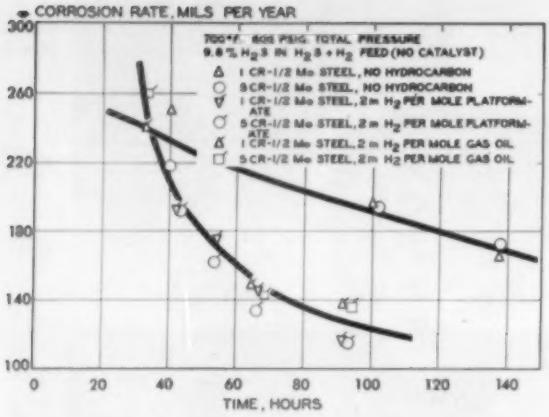
Paper presented at API division of refining midyear meeting, New York, May 27, 1959.

### Composition of Steel

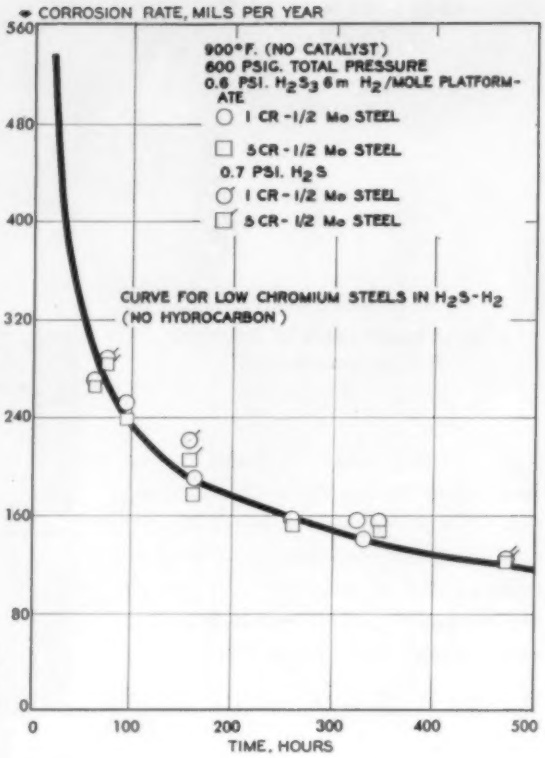
During the investigation corrosion rates of ferrous alloys, from pure iron through 12 Cr to 18 Cr-8 Ni steel, were measured. Throughout a wide range of hydrogen sulfide in hydrogen concentrations the relationship between corrosion rate and chromium content followed the pattern shown in Fig. 7B. This relationship is similar to that reported for several other investigations and summarized in the collection of data by Sorell and Hoyt.[13]

Another illustration of the effect of composition of ferrous alloys on corrosion rates in hydrogen sulfide-hydrogen mixtures is shown in Fig. 7A. This figure shows the relatively small improvement, particularly under severe conditions, that results from addition of up to 12% chromium at both low and high partial pressures of hydrogen sulfide. Only the 18 Cr-8 Ni steel showed markedly reduced rates under all conditions.

Analyses of sulfide scales formed from a range of ferrous alloys in both laboratory and refinery exposures revealed two points of interest. Iron-


CORROSION RATE, MILS PER YEAR
TIME, HOURS
700°F. 605 PSIG. TOTAL PRESSURE
9.8 % $H_2S$ IN $H_2S + H_2$ FEED (NO CATALYST)
1 CR-1/2 Mo STEEL, NO HYDROCARBON
5 CR-1/2 Mo STEEL, NO HYDROCARBON
1 CR-1/2 Mo STEEL, 2m $H_2$ PER MOLE PLATFORMATE
5 CR-1/2 Mo STEEL, 2m $H_2$ PER MOLE PLATFORMATE
1 CR-1/2 Mo STEEL, 2 m $H_2$ PER MOLE GAS OIL
5 CR-1/2 Mo STEEL, 2m $H_2$ PER MOLE GAS OIL

**EFFECT** of hydrocarbon on sulfiding rates under simulated hydrodesulfurizer conditions. Fig. 10.


CORROSION RATE, MILS PER YEAR
TIME, HOURS
900°F. (NO CATALYST)
600 PSIG. TOTAL PRESSURE
0.6 PSI. $H_2S$ 6m $H_2$/MOLE PLATFORMATE
1 CR-1/2 Mo STEEL
5 CR-1/2 Mo STEEL
0.7 PSI. $H_2S$
1 CR-1/2 Mo STEEL
5 CR-1/2 Mo STEEL
CURVE FOR LOW CHROMIUM STEELS IN $H_2S$-$H_2$ (NO HYDROCARBON)

**EFFECT** of hydrocarbon on sulfiding rates under simulated Platformer conditions. Fig. 11.

deficient ferrous sulfide was observed to be the main constituent of each of the two layers of sulfide scale in every case. In addition, there was a buildup of several elements, particularly chromium, in the inner layer formed on chromium steels (see Table and Fig. 8.)

Powder X-ray analyses confirmed these elemental analyses and, in addition, showed the chromium to be combined as the spinel structure $FeCr_2S_4$ (see Table 4). This latter compound would be expected to be very stable, by analogy with the similar oxygen compound, and is probably responsible for lower sulfiding rates of the higher chromium steels.

Microscopic examination of sulfide scales showed the outer layers to be similar in general appearance in all cases. Inner layers were quite different, however, compare Fig. 8 and 9. Those on pure iron were composed of relatively large crystals which formed an irregular, poorly defined transition to the outer layer.

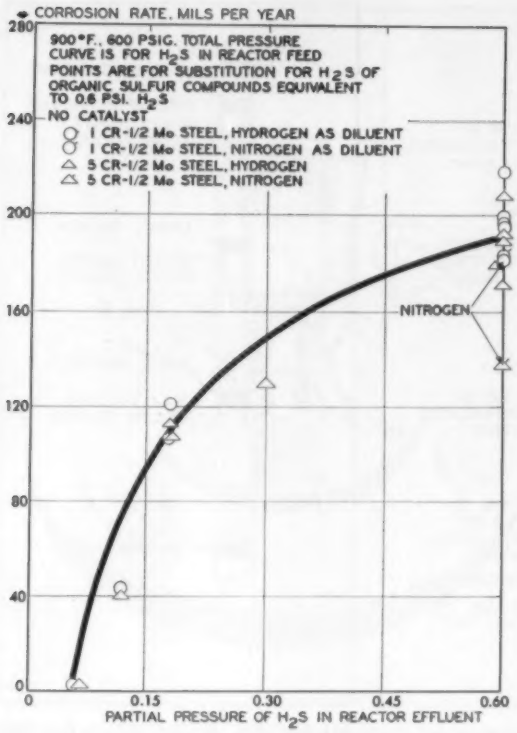
Inner layers on all chromium steels consisted of very fine crystals in a close-packed, sharply defined phase. Differences in physical structure of the two types of scales were not reflected in corrosion rates in the hydrogen sulfide-hydrogen system; only when the inner layer contained relatively high percentages of chromium were rates appreciably reduced.

### Corrosion by Organic Sulfides

Corrosion by organic sulfides is of interest because of the scaling problems which arise in charge heaters. To obtain an estimate of the relative corrosivity of various typical organic sulfides found in petroleum, an equiv-

**TABLE 3—CHEMICAL ANALYSES OF REFINERY SULFIDE SCALES**

| Alloy | Exposure Time (Days) | Scale layer | Chemical Composition (% by weight) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Fe | S | Cr | Ni | Mo | Mn | C | Si |
| ½ Mo | 62 | inner | 59.2 | 33.3 | 0.14 | 0.28 | 1.06 | 0.3 | ... | ... |
| | | outer | 60.6 | 35.1 | 0.1 | 0.19 | 0.08 | 0.3 | ... | ... |
| | 374 | inner | 59.0 | 34.0 | 0.2 | ... | 0.96 | 0.4 | 0.4 | 0.4 |
| | | outer | 58.7 | 34.9 | 0.3 | ... | 0.08 | 0.3 | ... | ... |
| 1 Cr-½ Mo | 62 | inner | 53.9 | 34.4 | 2.3 | 0.4 | 2.2 | 0.3 | ... | ... |
| | | outer | 55.4 | 35.1 | 0.2 | 0.2 | 0.3 | 0.3 | ... | ... |
| | 374 | inner | 55.5 | 34.2 | 1.9 | ... | 1.1 | 0.2 | ... | ... |
| | | outer | 59.5 | 35.1 | 0.5 | ... | 0.2 | 0.2 | 0.16 | 0.05 |
| 2¼ Cr-1 Mo | 62 | inner | 53.9 | 33.7 | 1.0 | 0.28 | 1.33 | 0.3 | ... | ... |
| | | outer | 57.6 | 35.4 | 0.2 | 0.15 | <0.05 | 0.2 | ... | ... |
| | 374 | inner | 54.1 | 34.0 | 3.8 | ... | 2.01 | 0.3 | ... | ... |
| | | outer | 57.8 | 35.0 | 0.9 | ... | 0.34 | 0.2 | ... | ... |
| 4 to 6 Cr-½ Mo | 62 | inner | 49.9 | 33.5 | 9.4 | 0.52 | 1.53 | 0.3 | ... | ... |
| | | outer | 48.8 | 35.1 | 0.6 | 0.31 | 0.33 | 0.3 | ... | ... |
| | 374 | inner | 50.0 | 36.8 | 8.0 | ... | 1.25 | 0.2 | 0.13 | 0.5 |
| | | outer | 57.0 | 35.3 | 2.8 | ... | 0.39 | 0.1 | ... | ... |
| 9 Cr-1 Mo | 62 | inner | 36.6 | 36.6 | 15.7 | 0.13 | 2.33 | 0.4 | ... | ... |
| | | outer | 62.1 | 35.5 | 0.3 | 0.62 | <0.05 | 0.3 | ... | ... |
| | 374 | inner | 36.1 | 37.3 | 16.4 | ... | 2.1 | 0.3 | 0.5 | 0.6 |
| | | outer | 50.0 | 35.4 | 0.4 | ... | <0.05 | 0.3 | ... | ... |
| 12 Cr (Type 405) | 374 | total scale | 25.4 | 38.8 | 23.7 | ... | 0.18 | 0.73 | 1.85 | ... |
| | | inner | 21.9 | 39.1 | 25.7 | 1.0 | 0.33 | 1.5 | ... | ... |
| 18 Cr-8 Ni (Type 304) | 62 | outer | 36.8 | 34.3 | 1.24 | 2.33 | 0.40 | 0.6 | ... | ... |




**COMPARISON** of the corrosiveness of organic sulfur compounds with that of hydrogen sulfide. Fig. 12.

alent amount of a number of these compounds was substituted for hydrogen sulfide.

These compounds were used in a series of runs in which ferrous alloys were exposed under simulated platformer conditions. In these runs, 6 moles of hydrogen or nitrogen were fed per mole of platformate containing organic sulfide equivalent to 0.6 psi. $H_2S$. Temperature was 900° F. at 600 psig. total pressure with no catalyst present.

This correlation is shown in Fig. 12, in which corrosion rates are plotted as ordinates with partial pressure of hydrogen sulfide in the reactor effluent as abscissae. The points plotted are those obtained from runs in which organic sulfides were fed; the curve is for comparison and was obtained from other runs in which an equivalent mole percentage of hydrogen sulfide was fed to the reactors under otherwise similar conditions.

Points obtained from 1 Cr steel in organic sulfides fall along the hydrogen sulfide curve within experimental variation. The single point for 5 Cr steel which is considerably below the curve was obtained in a run in which nitrogen was substituted for hydrogen in the feeds. This result is in agreement with experience which has shown that, in the absence of excess hydrogen, even low percentages of chromium improve the sulfide-corrosion resistance of steel.

Analyses of reactor-effluent gases indicated most aliphatic sulfides, disulfides, and straight or branched-chained mercaptans were essentially quantitatively converted to hydrogen sulfide by passing through a furnace tube when the residence time was of the order of 1½ min. at 900° F. (see Table 5).

The aromatic sulfide was only about 30% converted and the cyclic sulfur compounds, thiophene and benzothiophene, even less. These data serve as an indication of the extent of conversion of typical sulfides and thus the degree of corrosion to be expected from them.

Part 1 appeared in the June 1 issue of The Oil and Gas Journal. Part 3 will appear in the June 22 issue.

**TABLE 4—X-RAY ANALYSES OF SULFIDE SCALES**

| Alloy | Scale Layer | Chemical composition (% by weight) Fe | Cr | S | FeS Super lattice (Å) Relative Amount* | —Axes— a | c | $FeCr_2S_4$ Relative amount* |
|---|---|---|---|---|---|---|---|---|
| ½ Mo | outer | 58.7 | 0.3 | 34.9 | 100 | $3.43_4$ | 5.86 | undetected |
| | inner | 52.2 | 0.2 | 34.0 | 55 | $3.43_8$ | 5.87 | undetected |
| 2¼ Cr-1 Mo | inner | 54.1 | 3.8 | 35.5 | 70 | $3.44_8$ | ... | undetected |
| 5 Cr-½ Mo | outer | 57.0 | 2.8 | 35.3 | 80 | $3.44_2$ | 5.86 | 5 |
| | inner | 50.0 | 7.9 | 36.8 | 60 | $3.45_0$ | ... | 10 |
| 9 Cr-1 Mo | inner | 36.1 | 16.4 | 37.3 | 30 | $3.45_0$ | ... | 60 |
| 12 Cr (Type 405) | total scale | 25.4 | 23.7 | 38.8 | 10 | $3.44_6$ | ... | 100 |

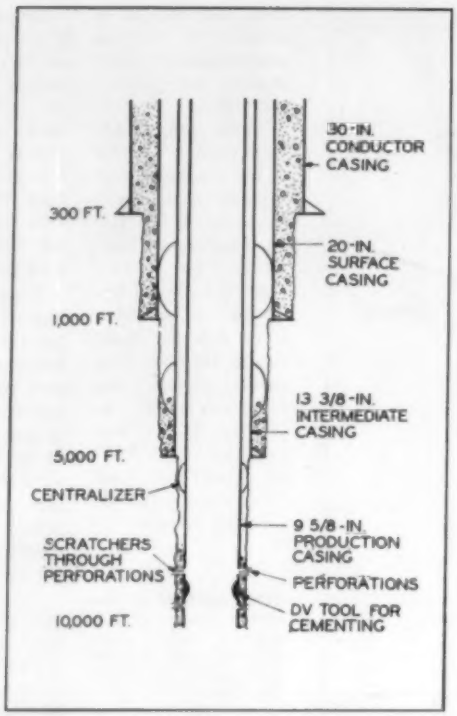
* Estimates based on maximum intensity = 100.

**TABLE 5—CORROSION OF FERROUS ALLOYS EXPOSED TO ORGANIC SULFIDES**
(Exposure Conditions: 900° F., 600 psig. Total Pressure, 6 Moles $H_2$ (or $N_2$) per Mole of platformate)

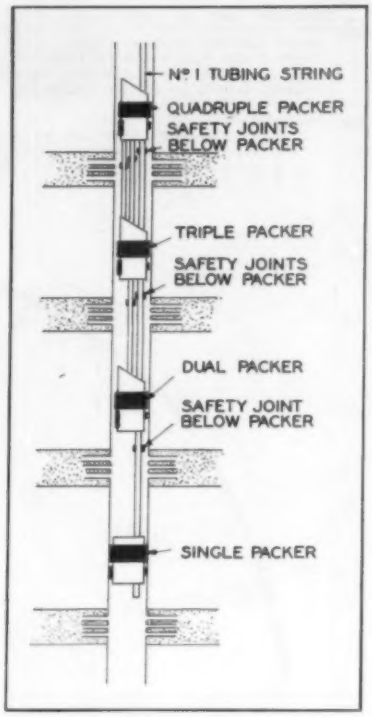
| Sulfur compound— | Moles sulfur (10)⁴ Total moles | Diluent gas | $H_2S$ pressure (psi.)* | Time (hours) | Corrosion rate (mils per year) 1 Cr-½ Mo | 5 Cr-½ Mo | 9 Cr-1 Mo |
|---|---|---|---|---|---|---|---|
| Ethyl sulfide | 10 | $H_2$ | 0.2 | 128 | 104<br>107 | 105<br>109 | 86 |
| Methyl disulfide | 10 | $H_2$ | 0.6 | 162 | 184<br>186 | 173<br>174 | 164<br>166 |
| Ditertiary butyl sulfide | 10 | $H_2$ | 0.6 | 184 | 203<br>205 | 181<br>182 | 151<br>155 |
| Ditertiary butyl disulfide | 10 | $H_2$ | 0.6 | 162 | 196<br>203 | 191<br>194 | ...<br>... |
| Normal butyl mercaptan | 10 | $H_2$ | 0.6 | 124 | 216<br>224 | 206<br>215 | 198<br>201 |
| Tertiary butyl mercaptan | 10 | $N_2$ | 0.6 | 137 | 170<br>196 | 138<br>141 | 42<br>57 |
| Tertiary butyl mercaptan | 10 | $H_2$ | 0.6 | 151 | 196<br>198 | 193<br>193 | 174 |
| Tertiary butyl mercaptan | 5 | $H_2$ | 0.3 | 166 | 137<br>139 | 126<br>134 | 99<br>109 |
| Thiophene | 10 | $H_2$ | 0.06 | 191 | 2.0<br>2.2 | 2.1<br>8.6 | 0.4<br>0.5 |
| Benzothiophene | 10 | $H_2$ | 0.1 | 140 | 43<br>44 | 40<br>42 | 16 |
| Phenyl sulfide | 10 | $H_2$ | 0.2 | 166 | 119<br>120 | 113<br>114 | 89<br>96 |

* Pressure hydrogen sulfide as indicated by analyses of reactor effluent gas.

## How CATC wells are multiple completed




**QUADRUPLE CASING DESIGN** is typical of the programs which have been used. Fig. 1.




**ALL PACKERS IN POSITION** before running Nos. 2, 3, and 4 strings. Fig. 2.

# Multiple completions put profit

**Though unpopular a few years ago, the multiple completion is here to stay. Production of several zones from one well can mean the difference between financial success or failure. This is especially true where formations are thin or otherwise marginal.**

ECONOMICS and conservation are the major advantages of multiple completions. Without the multiple completion, drilling in deep water would be economically impractical. The deeper the water the higher the cost of drilling and producing. And, the multiple completion enables the offshore operator to venture into deeper water. Without it, he would be forced to develop in very shallow water or onshore where the return is reasonable. If the offshore operator finds the multiple completion attractive, the onshore operator should find it more so.

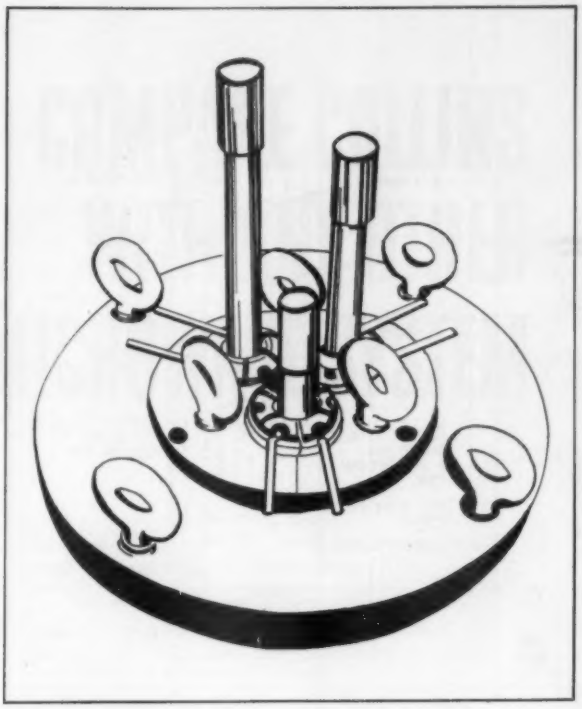
This article is a condensation of a paper titled, "Multiple Offshore Completions," delivered at 1959 spring meeting, Southern District, API Division of Production, New Orleans.

These completions add to petroleum reserves in another manner. The Miocene sands from which offshore Louisiana wells produce are predominantly thin sands with interbedded shale strings. Many of these minor stringers are virtually impossible to correlate over some of the high faulted oil and gas fields offshore. Large numbers of these lenses contain hydrocarbons. It would be economically impractical to drain these stringers and even widespread thin sand bodies without multiple completions.

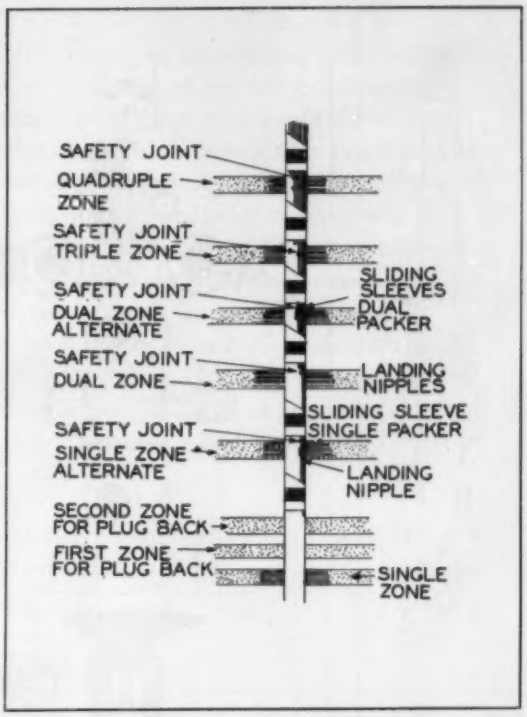
Another advantage of this type of completion lies in the practical economic development of an oil field. In determining optimum spacing and completion, it is important to have data from producing wells at an early date. From these data the operator can more accurately determine his drilling program. This can eliminate drilling of marginal wells.

There are other advantages:

1. Offset obligations of marginal zones may be fulfilled.
2. Over-all operating costs are reduced.
3. Reduction of the possibility of casing workover resulting from deterioration because of extended long life of well.
4. Quicker complete reservoir analysis.
5. Marginal zones, none of which would support a well, may be combined.
6. Extra tubing strings may be used on secondary-recovery injection wells.



**MULTISLIP TUBING BOWL** utilized in running three strings of tubing. Fig. 3.




**IDEAL QUADRUPLE STRING,** six-zone selective completion. Fig. 4.

# in offshore wells

BY WALTER W. POIMBOEUF, JR.,
AND WILLIAM W. CLEPLY
Continental Oil Co.

7. Eliminate some future recompletions.

8. Deplete well during the life of the offshore platform. These platforms are very expensive to replace and maintain. They cannot be expected to last indefinitely.

There are also, of course, disadvantages with multiple strings. One of the most important is that artificial lift of three or four zones will be extremely difficult. The problem will most probably be solved by the time there is extensive need for the solution.

One of the most frequently stated disadvantages is that future recompletion work will be extremely difficult. It is true that it will be more difficult to pull four strings of tubing and four packers than it would one, but each time a producing zone is made available to a tubing string in essence a recompletion job has been performed. In a quadruple completion, three potential remedial jobs have been performed before the well produces at all. In a quadruple completion with alternate producing zones, many more apparent remedial operations will be performed.

Also, the use of small-diameter concentric tubing for limited workover of wells has been very successful. With this method, there is no necessity of removing the tubing from the well.

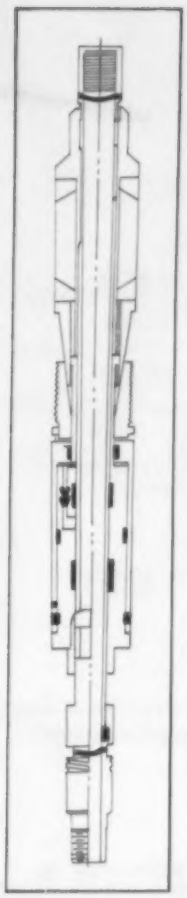
The multiple completion does restrict the use of permanent-type completions, but here again we have partially performed some of these anticipated operations and can still perform this type of operation on the lower zone in the well bore.

There is an increase of the possibility of downhole-equipment failure resulting from the increased volume of downhole equipment. Advance in design is reducing these possibilities.

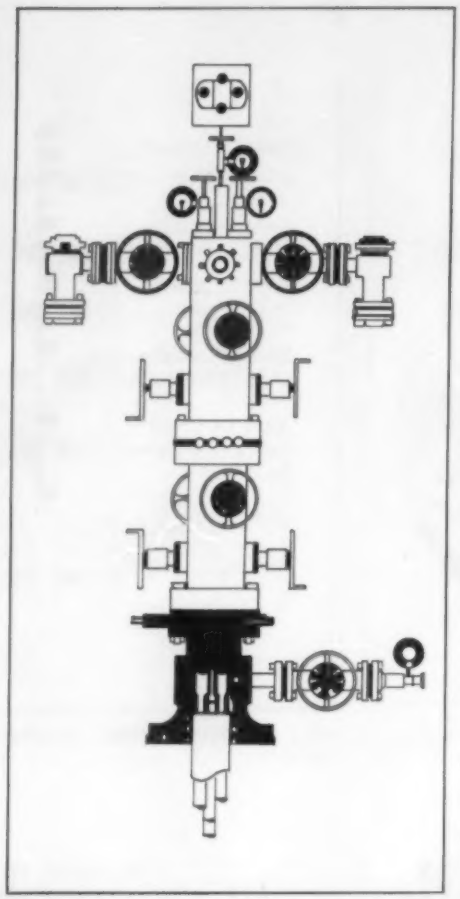
This increase in the amount of downhole equipment makes the running of this equipment in the hole more difficult and increases the cost of completing the well. These two factors are greatly overshadowed by the results.

**How many are made? . . .** In the multiple completion the advantages overshadow the disadvantages to such a degree that this type of completion, where applicable, has become the rule rather than the exception with some operators.

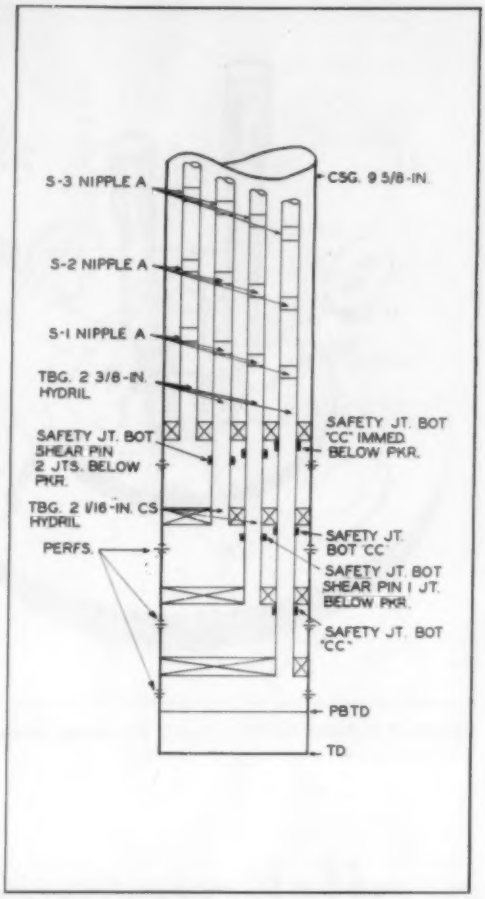
Around salt domes, frequently three or more separate reservoirs are encountered. Therefore, it may be expected that in time there will be more triple and quadruple completions performed offshore than dual and single completions. During the past year this has been proved a fact in the Harvey district CATC operation. During 1957, 29 offshore wells were completed. There was a total of 46 tubing strings in these wells or an average of 1.59 tubing strings per well bore. The district made its first triple completion in October of that year.



**HYDRAULIC** set packer of HS-8 type. Fig. 5.



**QUADRUPLE TREE** installed after all strings have been landed. Fig. 6.


S-3 NIPPLE A
S-2 NIPPLE A
S-1 NIPPLE A
TBG. 2 3/8-IN. HYDRIL
SAFETY JT. BOT SHEAR PIN 2 JTS. BELOW PKR.
TBG. 2 1/16-IN. CS HYDRIL
PERFS.
CSG. 9 5/8-IN.
SAFETY JT. BOT "CC" IMMED. BELOW PKR.
SAFETY JT. BOT "CC"
SAFETY JT. BOT SHEAR PIN 1 JT. BELOW PKR.
SAFETY JT. BOT "CC"
PBTD
TD

**QUADRUPLE COMPLETION** equipment after location in well. Fig. 7.

In June 1958, the first quadruple string was made in the district. During that year there were 31 wells completed using 72 tubing strings. This averages 2.32 tubing strings per well. These 31 wells consisted of 9 singles, 5 duals, 15 triple, and 2 quadruples. The majority of the single completions were in a single field in shallow water with only one productive sand. Two additional quadruple completions have been added in January and February 1959.

**When to make them . . .** There are four major factors necessary for successful completion of a quadruple-string flowing well. First, there must be four zones from which to produce. Second, there must be proper planning. Third, there must be the proper selection of equipment. Fourth, there must be proper supervision during the operation.

Little can be done about the presence or absence of four prospective zones. In development wells it is usually known, however, how many prospective zones will be encountered.

In planning before the well is drilled the equipment manufacturers are contacted as to availability of equipment. Most will be off-the-shelf items, but some may be especially made and require time. The casing program must be planned to accommodate multiple tubing strings.

When drilling has been completed and an electric log is available, final cementing programs must be completed. Perforation intervals must be selected. Special treatments must be evaluated. And the final equipment analysis must be formulated.

Zones should be completely separated, both inside and outside the casing. Produced fluids should be confined to individual tubing strings of a readily available size and type. There should be separate flow and pressure-control equipment for each of the tubing strings, including surface valves, subsurface valves, landing nipples, etc. Tubing strings should be full opening, or nearly so, to permit the passage of tools. It should be adaptable, as far as is practical, to perform corrective work on any one zone without disturbing another.

### A Typical Quadruple

On CATC quadruples, one of the programs used has been: 30-in. conductor pipe set at 300 ft.; 20-in. surface pipe at 1,000 ft.; 13⅜-in. intermediate casing at 5,000 ft., and the 9⅝-in. oil string at total depth of 10,000 ft. (see Fig. 1). One variation from this procedure would be to run a 7-in. liner in the lower portion of the well below 10,000 ft. to cover the lower two zones.

Running of casing in directional holes has many problems. There is a tendency for casing to wall stick.

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To alleviate this tendency, centralizers are run on each joint of casing in the directional portion of the well. In the straight portion of the hole centralizers are run on every other joint.

Scratchers are run only through the productive interval of the string. Normally, when a long column of cement is required, a DV tool is run on the casing string to cement the string at two different levels to insure covering all the desired casing area.

**Perforating and treating . . .** The mud in the casing is displaced with a weighted completion fluid. This fluid contains heavy salts, normally calcium chloride, in solution. Such a fluid will not contaminate the formation to be perforated and does not contain solids that may have a tendency to settle out on top of the packers after completion. Also, sand-consolidating plastics have more chance of success with this type fluid.

The calcium chloride solution can readily be mixed to weigh 11.8 lb. per gal. When fluid above this weight is desired, other fluids must be used.

Next the upper zone to be produced is perforated. A 5-ft. section with four shots per foot is the normal interval. This zone is plastic consolidated to reduce the possibility of sand production. Miocene sands, being poorly sorted and poorly consolidated, have caused considerable trouble in producing. By holding the perforated interval to 5 ft., the sand consolidation with plastic has a better chance of success. Extremely large perforated intervals reduce this possibility.

After treatment of the upper zone, the next lower zone is perforated and treated in like manner. After this, the next lower zone, etc., until all have been treated. Any questionable producing zone is first tested and, if unproductive, squeezed before any other zone is perforated and treated.

When all the zones are treated, the well is conditioned. A casing gage is run to insure the success of future operations.

**Running the packers . . .** A wire-line single-retainer-type packer is run and set above the lowermost perforations. Frequently, there may be two or three small productive stringers below the packer that are not perforated. Setting the packer above these minor stringers enables future plugbacks with permanent-type-completion equipment.

Next the long number one string is spaced out and run in the hole. Also on the number one string are all multiple packers and that portion of all other tubing strings which extend below the quadruple packer (see Fig. 2). When the number one string has been hung in the tubing hanger, the single packer is tested and the three remaining strings are run individually, latched in the quadruple packer by means of an automatic-latch right-hand release J-tool, and hung in the tubing hanger. Fig. 3 depicts the multislip tubing bowl utilized in running three strings of tubing between the triple and quadruple packers.

Hydraulic packers are used so that all tubing strings below the uppermost packer can be run in the hole on the number one string. Fig. 5 is a cutaway of the single hydraulic set packer. The dual, triple, and quadruple are operated in the same manner. Special unions are incorporated on the bottom of the quadruple and triple packers to tie the second and third strings to these packers.

**Setting the packer . . .** When all the strings have been landed in the tubing hanger and back-pressure valves installed in the tubing, the blowout preventers are removed and the quadruple tree installed (see Fig. 6). The back-pressure valves are removed. In order, the single packer is tested for communication; the quadruple packer is set by applying pressure to the number four string and tested by applying pressure to the casing annulus; the triple packer is set by pressuring the number three tubing string and tested by pressuring up the number four string; and the dual packer is set by applying pressure to the number two string and tested by applying pressure to the number three string.

There are three methods of setting these packers. A plug can be pumped down and seated in the packer. Pressuring the tubing causes a differential across the packer causing it to set. In turn the plug can be removed with a wire line. A second method is to pump a plug down on a specially designed seat. Continued increase in pump pressure causes the plug seat to shear and allow the plug to drop through the bottom of the packer.

The third method is that of using a plastic ball to seat and plug off the tubing. This ball then can either be pumped or flowed out of its tubing string. The plastic-ball method is used here in most cases.

The wire-line removable plug method is satisfactory, but wire lines are kept out of directional holes. Most deep-water offshore wells are directional. The pump-out plug method has been tested but has proved unsatisfactory. When the plug seat shears, the high differential pressure release reacts as a piston and has caused packer failures.

**Other equipment . . .** Fig. 6 shows the completion run in the well. There are numerous landing nipples and safety joints in the different tubing strings. The S-3 landing nipples are for setting plug chokes in the completed wells during rig moves or other critical platform operations. The S-2 nipples are used for landing storm chokes for safety. The S-1 nipples can be used for setting plugs low in the tubing string during possible future workovers. The safety joints are installed for easier operation in case of equipment failure during future possible workovers.

For safety, completion fluid is left in the casing above the upper packer. Should there be damage to the wellhead which may cause the well to be open to the atmosphere, the tubing storm choke will stop the flow out of the tubing, but should the packers also fail, the heavy fluid will kill the well. Leaving the annulus full of heavy fluid is mandatory offshore.

For further safety the tree is equipped with dual master valves. The upper valve is equipped with a safety system which will cause it to close if there is excessive damage to the tree above this valve, which would cause the well to flow to the atmosphere.

The previously summarized completion is merely an example. Each well should be an individual and its completion should be specially designed. Fig. 4 depicts a completion designed for eight productive zones. This completion is so designed as to eliminate as far as possible any major remedial work. The door is now open for some operator to make a five-zone completion. Who knows where it will stop?

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# The economics of two-stage cat cracking

**A commercial two-stage catalytic cracking plant has been in operation at the Anacortes refinery of Shell Oil Co. for about 3 years. This article presents a brief description of the unit, commercial experience with several types of feed stocks, the results of engineering studies of certain features of the unit, and a summary of a detailed economic analysis of the process.**

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Shell Oil Co.
and W. V. MEDLIN
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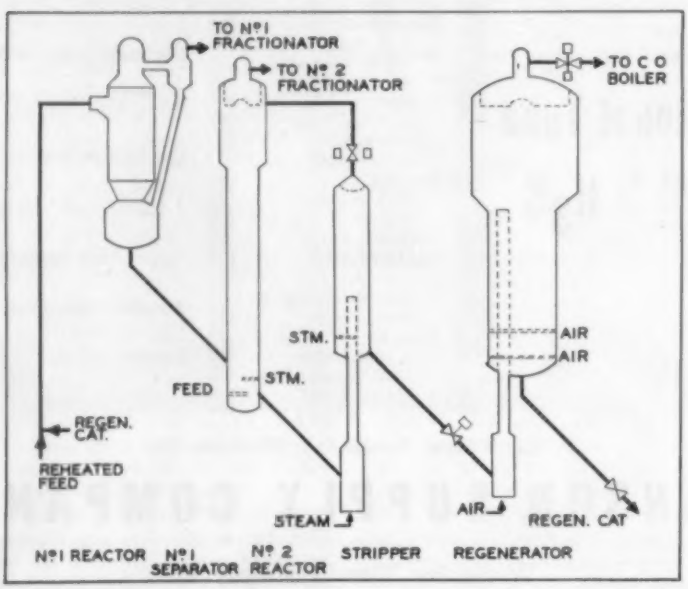
DATA obtained while cracking feed stocks prepared from Alberta, Ventura, and Four Corners crude oils indicate the yield of 10-lb. R.v.p. gasoline (including polymer) to be 63 to 75% by volume when conversion ranges from 70 to 79% by weight. The retention of olefin products in the light-gas streams and gasoline fraction is a direct result of the design of the unit.

Catalyst densities measured by gamma-ray attenuation, injection of catalyst tagged with scandium-46 and helium injection have been used to study the flow patterns of both catalyst and gas. Only a moderate degree of back mixing of gas and catalyst flow prevails in the regenerator. The specific burning rate of carbon in the regenerator is high, and appears to approach the maximum obtainable rate predicted from laboratory kinetic data.

An economic comparison of two-stage and single-stage catalytic cracking has been calculated within the framework of a model refinery operating under conditions which yield the maximum profit for each process. The desired gasoline-to-distillate-fuel ratio has a large influence on both the recycle pattern and the choice of process. As this ratio increases, as is the future trend, the catalytic cracking unit is required to operate at higher conversion and the two-stage process is shown to be more and more preferable.

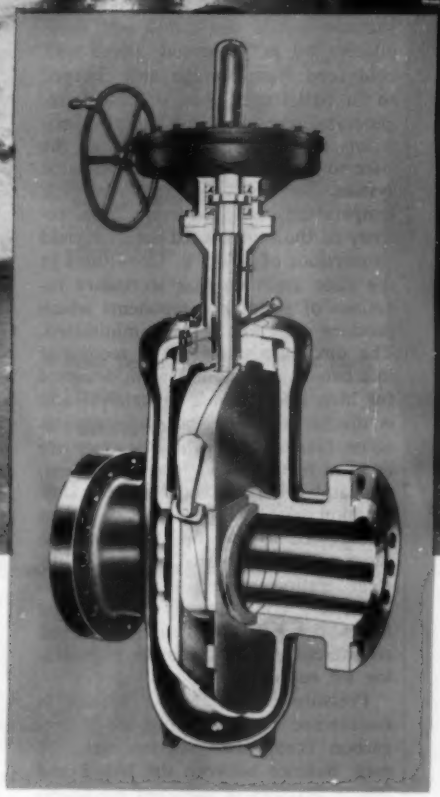
A commercial two-stage catalytic cracking plant (OGJ, May 21, 1956, p. 230) has been in operation at the Anacortes refinery of Shell for about 3 years. The design of the unit used new features in both process and mechanical design, including a short-contact-time riser reactor with separator and an unusually efficient regenerator. During its onstream time sufficient operating experience has been obobtained to evaluate the various features of the plant. In addition, research teams have completed studies evaluating the new features.




**PROCESS FLOW** for catalytic section of Anacortes two-stage cat cracking unit. Fig. 1.

## Description of Unit

The unit consists of two reaction stages, two fractionators, a catalyst stripper, and a regenerator. The riser reactor first-stage system was sized for



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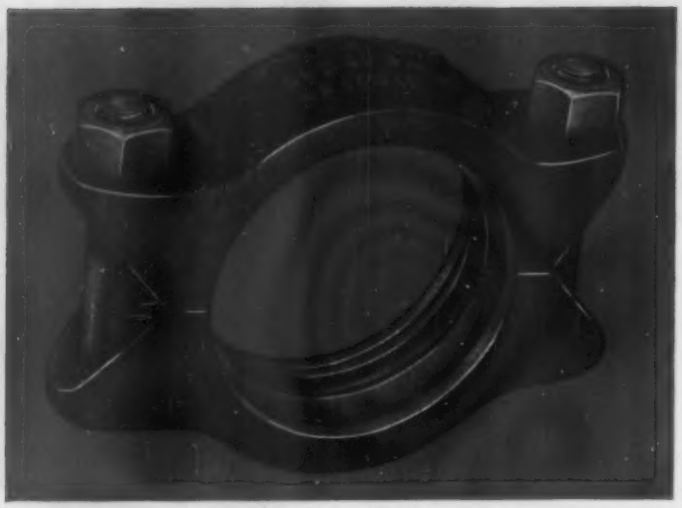

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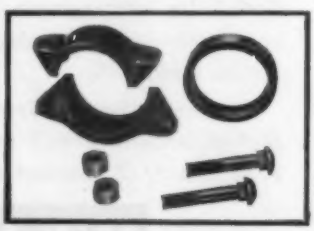

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an intake of 23,600 bbl. per day to give 40-50% conversion. The second stage was designed to charge gas oils from the first stage along with a recycle stream to give over-all conversions of 63-72%. The unit has been run at charge rates of 13,000 to 30,000 bbl. per day and total conversions from 65-90%. The regenerator burns up to 32,000 lb. per hour of coke.

Flow through the unit is shown in Fig. 1. A hot feed stream consisting of heavy straightrun gas oils, deep-vacuum-flashed distillates, and deasphalted oil is preheated along with cold feed from storage and charged to the first stage. There it contacts regenerated catalyst, and the two materials flow concurrently through the riser to an elevated cyclone separator system. The short contact time, high temperature, and relatively high activity of the regenerated catalyst yield conversions of 40-55%. Conditions in the riser are such that secondary reactions of gasoline components which produce coke and gas are minimized. The circulating catalyst is recovered in a two-stage cyclone system designed for high inlet loading of catalyst and is discharged to the second-stage reactor. Gas oils from the first stage are cracked further in a dense bed system, the catalyst is steam stripped in a combination riser-dense bed unit, then transported to the top section of the regenerator by means of an air lift. Regeneration, started in the regenerator riser, continues as the catalyst flows downward through the bed countercurrent to the main regenerator air supply.

Pressure on the No. 1 reactor is maintained by controlling the hydrocarbon compressor suction near 10 psig. Balance between the No. 2 and No. 1 reactors is achieved by applying back pressure with a butterfly valve in the No. 2 wet-gas stream. The catalyst stripper pressure is held relative to the No. 2 reactor pressure by means of a slide valve in the stripper vapor line. Normal regenerator operating pressure is 16 psig., controlled with a valve in the flue gas line.

The plant was designed as a heat balanced unit without regenerator cooling coils, and catalyst circulation rate is used to heat balance the regenerator. Temperature in the No. 1 reactor is maintained near 1,000° F. with preheat while the No. 2 reactor is cooled to 900° F. by recycling No. 2 reactor gas oils. Catalyst slide valves control the bed levels in the regenerator and stripper, while stripper riser steam rate controls bed level in the No. 2 reactor.

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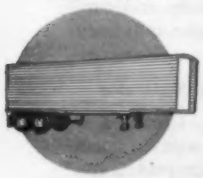

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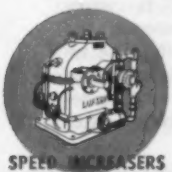

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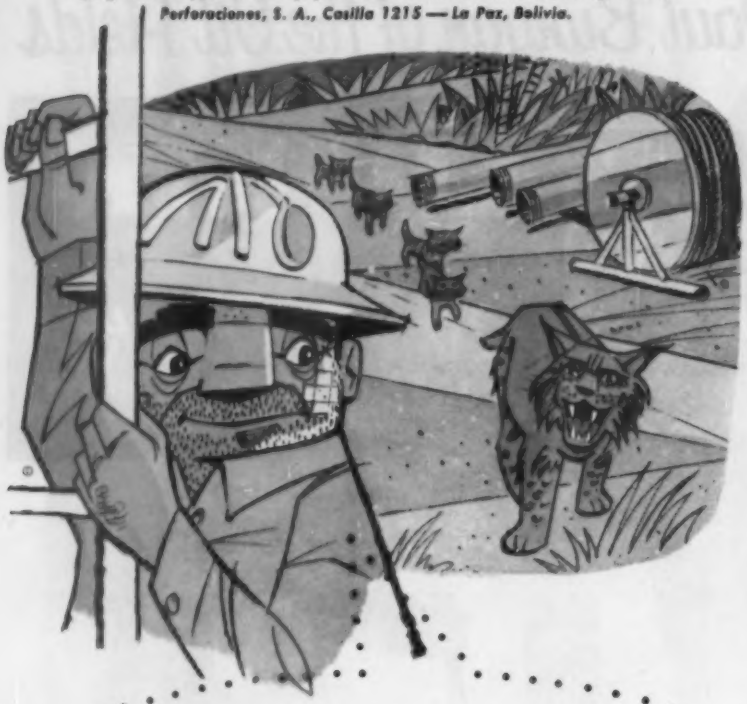

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minimum catalyst level in the No. 2 reactor and severity of cracking has been controlled by catalyst rate, reactor temperatures, diluent and recycle. Intake rate and crude source influence the conversion level; however, conversion has generally been above 70%.

### Yields

The Anacortes unit has cracked feed stocks prepared from California, Four Corners, and imported crudes. Feed rate to the unit has ranged from 13,000 to 30,000 bbl. per day and conversions from 65 to 90% have been achieved. Yield structures, product properties, and composition of feeds are given in Tables 1 to 5, representing operation with several crudes.

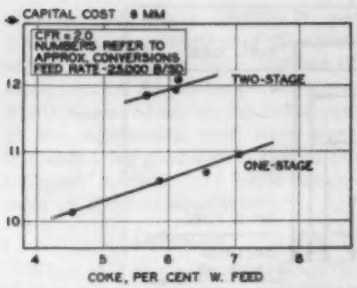
At comparable intake rates Alberta and Four Corners crudes gave similar yields. The Ventura crude, however, gave higher coke yields and less gasoline, and increased the metallic contamination of the catalyst. The effect of increasing intake rate with the Alberta crude was to reduce conversion and 10-lb. R.v.p. gasoline yield primarily through reduction in light olefins.

The data clearly indicate that the two-stage process produces a substantial yield of high-quality gasoline. Gasoline octane numbers are similar to those of products from once-through operations. The retention of olefin products in the light-gas streams and gasoline fraction is a result of the riser reactor and two-stage features of the plant.

Catalysts charged to the unit have consisted of used catalyst from other units and fresh synthetic and natural catalysts. Catalyst activity maintenance, as indicated by the surface area and pore volume of the equilibrium catalysts reported in Table 4, has been exceptionally good compared to conventional units. Fresh-catalyst additions rates have varied from 3 to 12 tons per day and equilibrium surface area has ranged from 120 to 175 sq. m./g. Catalyst-replacement rate on the unit has been controlled to obtain the desired contaminant removal. Resulting variations in activity and particle-size distributions have not been of concern.

### First-Stage Reactor and Separator

The first-stage or No. 1 reactor is a riser lined internally with hexsteel and refractory for erosion protection. The lower 50 ft. is a straight vertical section while the upper 75 ft. curves along an elliptical arc entering the No. 1 separator horizontally. The elliptical design was chosen to minimize pressure drop in the riser and to reduce erosion in the top bend. After




**ESTIMATED** capital costs of single-stage and two-stage cat cracking units, with intake capacity of 25,000 bbl. per standard day. Fig. 2.

more than a year of operation, the liner was in good condition. Minor spalling of ⅛ in. was found particularly in the engagement section. Erosion at the top of the riser bend was negligible.

The No. 1 reactor has been the subject of considerable investigation. Catalyst holdup was measured by the gamma-ray attenuation technique of Bartholomew and Casagrande. Special nozzles along the reactor permitted sampling of the vapors with retractable porous metallic filters, and it was therefore possible to obtain conversions and product distributions. Catalyst samples taken from the separator standpipe were used to determine the coke yield from the first stage. To determine the correct amount of carbon on the catalyst in the separator standpipe, a vacuum stripping technique was devised which rapidly sampled the catalyst stream and removed the hydrocarbon atmosphere.

### Second-Stage Reactor and Catalyst Stripper

In order to provide a great amount of flexibility in the operation of the unit, the second-stage, or No. 2, reactor was built for catalyst inventories ranging from 30 to 120 tons. The vessel has a weir in the bottom separating the reaction zone and catalyst drawoff section. Second-stage feed and recycle are injected as liquid through multiple nozzles located below the catalyst inlet. The spent catalyst is contacted with steam in the drawoff section to give a partial stripping stage.

The No. 2 reactor has not been extensively evaluated; however, yield structures have been obtained by sampling products from this reactor.

Due to the nature of the second-stage feed and to the difference between dense bed and riser cracking, the yields of gasoline, valuable light olefins, and coke are not as favorable from this reactor as from the No. 1 reactor.

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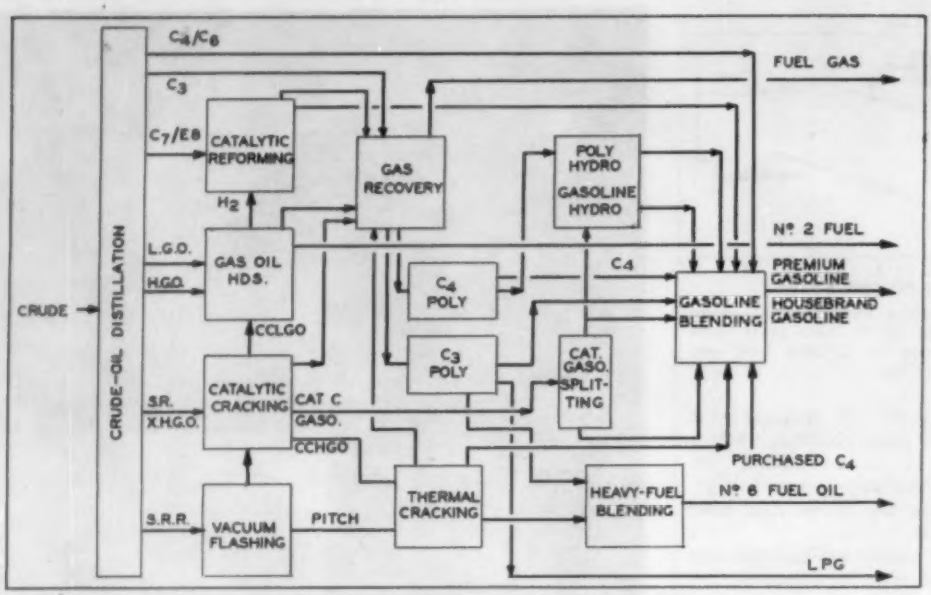


**FLOW SHEET** for model refinery. Fig. 3.

**TABLE 1—FEED STOCK AND YIELDS FOR COMMERCIAL TWO-STAGE CATALYTIC CRACKING**

| Type of feed stock: | Alberta I | Alberta II | Ventura I | Ventura II | Four Corners I |
|---|---|---|---|---|---|
| Charge rate, B/D | 19,958 | 29,865 | 20,522 | 17,899 | 21,257 |
| **Feed-stock properties:** | | | | | |
| API gravity | 26.5 | 27.1 | 25.0 | 24.5 | 28.6 |
| Engler distillation, °F.: | | | | | |
| I.b.p. | 505 | 500 | 457 | 436 | 400 |
| 10% | 610 | 575 | 565 | 550 | 473 |
| Pour point, °F. | +65 | +70 | +70 | +75 | 0 |
| Ramsbottom carbon: | | | | | |
| Residue, wt. % | 0.82 | 0.69 | 0.39 | 0.59 | 0.60 |
| Sulfur, wt. % | 0.80 | 0.75 | 0.86 | 0.78 | 0.39 |
| **Cracking yields, vol. %:** | | | | | |
| Ethane and lighter, wt. % | 3.8 | 3.3 | 4.9 | 6.2 | 3.2 |
| Propylene | 10.3 | 7.8 | 8.5 | 8.5 | 10.2 |
| Propane | 3.5 | 3.9 | 3.1 | 2.6 | 2.8 |
| Butylenes | 12.9 | 10.3 | 11.0 | 10.8 | 12.3 |
| Isobutane | 5.3 | 3.0 | 4.2 | 2.6 | 8.4 |
| Normal butane | 1.2 | 0.7 | 0.8 | 1.3 | 1.3 |
| Debutanized 450° F. cut-point gasoline | 53.6 | 51.5 | 44.7 | 48.2 | 52.0 |
| Light gas oil | 11.3 | 18.2 | 15.5 | 10.8 | 11.0 |
| Heavy gas oil | 9.4 | 11.3 | 15.4 | 13.1 | 10.2 |
| Coke, wt. % | 8.7 | 6.9 | 9.9 | 12.1 | 8.4 |
| 10-lb. R.v.p. gasoline (incl. $C_6$ and $C_4$ polymer) | 75.6 | 67.1 | 62.8 | 66.4 | 73.0 |
| Conversion, wt. % | 78.6 | 69.9 | 69.6 | 74.7 | 78.1 |

subjects the catalyst to two stages of stripping. The first occurs in the stripper riser where the spent catalyst from the No. 2 reactor flows concurrently upward with a large amount of steam and is disengaged by means of a splash plate over the riser. The catalyst falls into a dense bed where it is further stripped of entrained and absorbed hydrocarbon by additional steam from distributors in the bed. An offset 30° conical drawoff section was used to reduce entrainment of steam from the stripper.

Stripper efficiencies have been estimated on the basis of samples taken from the stripper standpipe, calculated void fractions, and catalyst-circulation rates. At the usual catalyst rate of about 30 tons per minute and normal reactor conditions, the amount of hydrocarbon entrained is equivalent to only about 1,000 lb. per hour, which is about 4% of the total regenerator load and less than 0.5% of the fresh feed.

Vacuum-stripped samples of catalyst taken at the entrance to the stripper riser and at the stripper standpipe under a wide variety of conditions show that there is no measurable increase in coke content of the catalyst as it passes through the stripper. This lack of additional coke laydown is due to the rapid and thorough initial stripping of the catalyst in the riser, since it has been observed only in strippers with steam risers.

### Regenerator

The regenerator is an elevated vessel designed for bottom drawoff of catalyst and countercurrent contacting of spent catalyst and air. A riser to lift stripped catalyst to the top of the regenerator bed with air was used in the design to provide countercurrent flow in the regenerator. A separate blower provides the transport air which amounts to 10% of the total air used for burning the coke.

Specific burning rates have been calculated for this regenerator covering a wide range of operating conditions. The burning rates, calculated as pounds of carbon burned per hour per pound of carbon in the regenerator per unit of log mean oxygen partial pressure, are the same as those used by Johnson and Mayland and others for the comparison of pilot plant and laboratory fixed-bed rates. The rates in this regenerator are quite close to the laboratory rates. Specific burning rates for a number of other Shell commercial regenerators have been calculated from unpublished data, and when compared on this basis, they fall considerably below the laboratory rates.

Normally the regenerator riser is

operated with about 20,000 lb. per hour of air distributed over the cross-section of the riser by a number of small nozzles. Radial temperature gradients measured across the lower part of the regenerator riser were quite flat, indicating good distribution of the transport medium and rapid attainment of thermal equilibrium.

### Operation

When the unit was brought up to design feed rate after startup, rather severe fluctuations in catalyst flow rate caused periodic surging of pressures and temperatures in the unit. This behavior, nicknamed "blipping," was most evident in the pressure above the regenerated catalyst slide valve and the differential pressure across the regenerated catalyst standpipe.

Gamma-ray attenuation studies and helium-tracer experiments on both the regenerator and stripper standpipe showed that the catalyst entering the sloping standpipe was deaerating, giving a dense phase on the lower section with vapors collecting and flowing upward along the top section of the pipe. When these gas bubbles broke through the screen of catalyst at the standpipe inlet catalyst flow would momentarily stop. The standpipe would then fill with catalyst and the cycle would repeat. There was a critical mass flow rate below which this action occurred.

During the 1957 turnaround several revisions were made to eliminate this restriction on operation. When the standpipes were lined for erosion protection, their diameter was reduced to 32 in. by installing a 2-in. layer of insulating material behind the hexsteel. Straightening vanes were installed at the inlet to both regenerated and stripper standpipes to distribute catalyst evenly over the exit from the vessels. In addition, vent pipes were installed to carry vapors from the upper part of the standpipe into the bed, thereby bypassing the point where the downflowing catalyst and upflowing vapors met in countercurrent flow. Subsequent tests have shown the "blipping" phenomenon has been eliminated by these revisions.

Catalyst losses through the stack have been consistent at 3-4 tons per day since startup, and catalyst concentration in both fractionator bottoms streams has averaged 0.02-0.03 lb. per gal. because of the efficiency maintained by the reactor cyclones. As a result of reactor recovery-system performance, maintenance on the slurry system and pumps for both fractionators has been minor.

### Economics

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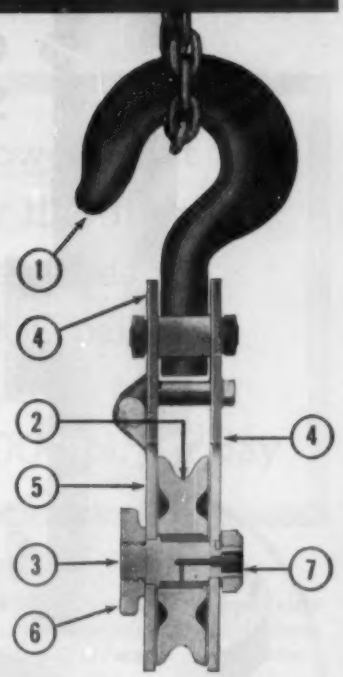


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of two-stage and single-stage catalytic cracking, it is evident at the outset that the basis to be chosen for comparing the processes is important. For example, if they are compared at equal conversions, then the higher the chosen conversion the more will two-stage cracking be favored. Similar objections can be made for other simple bases, e.g., equal coke yields or equal recycle ratios. An adequate comparison is indeed possible only if each process is fully utilized for maximum profit, operating under conditions of conversion, temperature, recycle ratio, etc., that will achieve this goal. Although this type of comparison involves an extensive study, it is believed to be justified in the present case.

A complication arises because of the intermediate position of the catalytic cracking unit in the refinery stream, since all products must be blended or further processed prior to sale. Since it is difficult to assign correct values to these intermediate products, it was decided to calculate the economics within the framework of a model refinery set up according to a typical flow scheme to produce only salable products. For purposes of simplification, only a single feed stock was employed, namely, West Texas crude oil, and conventional vacuum flashing was assumed for feed preparation for the catalytic cracking unit.

Rather extensive calculations produced a great deal of information and permitted a large amount of exploration among the various operating conditions, yields, and costs. One example of the results is shown in Fig. 2, which is a plot of the capital costs of one and two-stage units against coke yield, for units having the same combined feed ratios (ratio of total feed to fresh feed). Capital costs as shown include an amount for gas-recovery facilities but do not allow for utilities or other offsite items. On this basis, the estimated cost of a two-stage unit was found to exceed that of a single-stage unit by about 13%. On the basis of equal conversions, the difference would evidently be much smaller, or even reversed. Many other plots of the calculation results were made, and by assigning arbitrary values to the various products from the catalytic cracking units, it was possible to gain a considerable understanding of the effects of conversion, recycle, regenerator temperature, stripping steam usage, and other variables upon the profitability of the process. This approach permitted certain of the catalytic cracking cases to be chosen for the subsequent model refinery calculations.

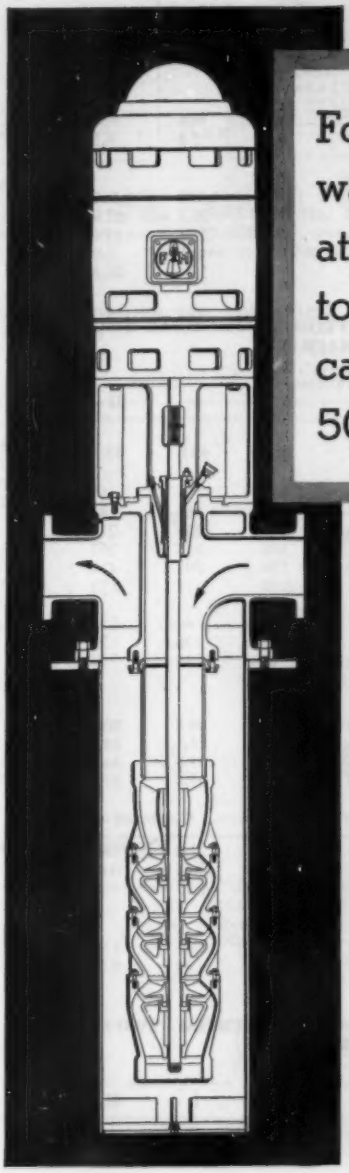
Fig. 3 is a flowsheet of the assumed

model refinery. Hydrogenation of butylene polymer was included because of the large increase in octane number which results, particularly in the motor rating. Splitting of the catalytically cracked gasoline and subsequent hydrogenation of the light portion was also included to control octane sensitivity. The economic criterion was the average cost of all gasoline when made in a fixed amount of 30,000 bbl. per calendar day, taking into account costs of raw materials and operation, the estimated total capital cost of the refinery amortized at an assumed rate, and credits for byproducts. The calculation of this cost also was programed for automatic computation, arranged so that input data regarding the catalytic cracking unit could easily be changed from case to case. For any given catalytic cracking case, the procedure was as follows:

1. Introduce as input data the catalytic cracking yield structure and the necessary information on catalytic cracking costs.
2. Determine the minimum amount of hydrodesulfurization feed required to meet a predetermined sulfur specification for finished No. 2 fuel oil. Assume the rest to bypass the hydrodesulfurization unit.
3. Determine the yields on thermally cracking catalytically cracked heavy gas oil, from an assumed correlation against its gravity.
4. With the yields and properties of the gasoline components tabulated, blend them into housebrand and premium grades of predetermined volumetric ratio, in such a way that the premium grade containing 3 cc. TEL/gal. will have a maximum research octane number. To do this, split catalytically cracked gasoline into light and heavy portions to the extent necessary to meet boiling-range specifications, and partially hydrogenate enough of the light fraction to lower sensitivity of both grades to the required level. Purchase butane to the extent required by vapor pressure specifications. Use only enough tetraethyl-lead in housebrand gasoline to meet a predetermined difference in octane number between the two grades.
5. Scale the entire refinery to make 30,000 bbl. per day of total gasoline.
6. Determine the costs for capital, operation and raw materials, and assign values to by-products.
7. Calculate the cost of gasoline, taking into account a credit for its octane number at an arbitrarily assigned rate.

There were five types of catalytic cracking operations chosen for evaluation in the model refinery. Two cases were single-stage. One employed


# NEW Fairbanks-Morse Inverted Pot-Type Turbine Injection Pump



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Installations may be single or in series, depending on specific components selected for head capacity requirements. Power may be F-M direct electric drive, or right-angle drive with F-M motor or O-P diesel.

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**TABLE 2—OPERATING CONDITIONS FOR COMMERCIAL TWO-STAGE CATALYTIC CRACKING**

| Type of feed stock: | Alberta I | Alberta II | Ventura I | Ventura II | Four Corners I |
|---|---|---|---|---|---|
| First-stage reactor: | | | | | |
| Temperature, °F. | 983 | 990 | 1,003 | 1,001 | 983 |
| C/O | 14.9 | 12.0 | 13.3 | 13.6 | 14.3 |
| Conversion, wt. % | 59.9 | 47.6 | 47.2 | 51.4 | 53.0 |
| Combined feed ratio | 1.0 | 1.0 | 1.0 | 1.27 | 1.0 |
| Second-stage reactor: | | | | | |
| Temperature, °F. | 898 | 919 | 918 | 917 | 907 |
| Conversion, wt. % | 46.6 | 42.7 | 42.4 | 47.9 | 53.4 |
| Combined feed ratio | 1.51 | 1.12 | 1.41 | 1.92 | 1.51 |
| Stripper: | | | | | |
| Temperature, °F. | 889 | 910 | 908 | 908 | 900 |
| Steam, lb./M. lb. circ. cat. | 5.3 | 4.2 | 5.8 | 6.5 | 4.7 |
| Regenerator: | | | | | |
| Temperature, °F. | 1,092 | 1,132 | 1,140 | 1,141 | 1,095 |
| Coke-burning rate, M. lb./hr. | 23.2 | 27.7 | 26.1 | 27.9 | 22.7 |
| $CO_2/CO$ | 1.18 | 1.11 | 1.05 | 1.08 | 1.10 |
| $O_2$ in flue gas, vol. % | 0.4 | 0.3 | 0.7 | 1.0 | 0.4 |
| Catalyst circulation, T/M | 32.6 | 38.8 | 30.1 | 26.8 | 32.3 |

**TABLE 3—PROPERTIES OF PRODUCTS FROM COMMERCIAL TWO-STAGE CATALYTIC CRACKING**

| Type of feed stock: | Alberta I | Alberta II | Ventura I | Ventura II | Four Corners I |
|---|---|---|---|---|---|
| Depentanized gasoline: | | | | | |
| API gravity | 50.7 | 50.8 | 48.6 | 53.9 | 50.8 |
| ASTM dist., °F.: | | | | | |
| I.b.p. | 159 | 162 | 158 | 116 | 158 |
| 10% | 189 | 191 | 186 | 143 | 184 |
| 50% | 240 | 249 | 259 | 226 | 251 |
| 90% | 351 | 348 | 355 | 367 | 363 |
| F.b.p. | 388 | 379 | 391 | 410 | 397 |
| Surfur, wt. % | 0.11 | 0.09 | 0.18 | 0.23 | 0.04 |
| Hydrocarbon type analysis, vol. %: | | | | | |
| Olefins | 49 | 52 | 49 | 57 | 42 |
| Aromatics | 31 | 33 | 36 | 29 | 33 |
| Saturates | 20 | 15 | 15 | 14 | 25 |
| Octane ratings: | | | | | |
| Motor | 81.9 | 80.5 | 80.8 | 80.8 | 81.1 |
| Motor +3 cc. TEL | 85.4 | 84.8 | 84.5 | 84.1 | 85.9 |
| Research | 95.1 | 94.2 | 93.8 | 94.9 | 93.9 |
| Research +3 cc. TEL | 99.0 | 98.4 | 97.8 | 97.9 | 98.5 |

| Gas oils: | Light | Heavy | Combined | | |
|---|---|---|---|---|---|
| API gravity | 26.8 | 23.4 | 23.0 | 21.8 | 19.4 | 27.7 |
| Sulfur, wt. % | 0.92 | 0.90 | 1.00 | 0.84 | 0.87 | 0.39 |
| Pour point, °F. | −5 | +65 | +35 | +15 | +25 | 0 |
| Decanted oil: | | | | | | |
| API gravity | | 13.9 | 12.8 | 15.3 | 13.3 | 21.7 |
| Sulfur, wt. % | | 1.07 | 1.09 | 0.80 | 0.78 | 1.11 |

**TABLE 4—CATALYST PROPERTIES FOR COMMERCIAL TWO-STAGE CATALYTIC CRACKING**

| Type of feed stock: | Alberta I | Alberta II | Ventura I | Ventura II | Four Corners I |
|---|---|---|---|---|---|
| Surface area, sq. m./g. | 146 | 131 | 132 | 136 | 127 |
| Pore volume, ml./g. | 0.38 | 0.37 | 0.37 | 0.39 | 0.35 |
| Particle-size distribution (by sedimentation), wt. %: | | | | | |
| <40 μ | 5 | 8 | 2 | 5 | 6 |
| >75 μ | 34 | 46 | 40 | 38 | 41 |
| Contaminants analysis, wt. %: | | | | | |
| Iron | 0.170 | 0.160 | 0.177 | 0.174 | *0.235 |
| Vanadium | 0.022 | 0.020 | 0.009 | 0.013 | 0.015 |
| Nickel | 0.026 | 0.026 | 0.040 | 0.035 | 0.029 |
| Copper | 0.002 | 0.002 | 0.002 | 0.002 | 0.004 |
| Chromium | 0.004 | 0.003 | 0.003 | 0.003 | 0.003 |

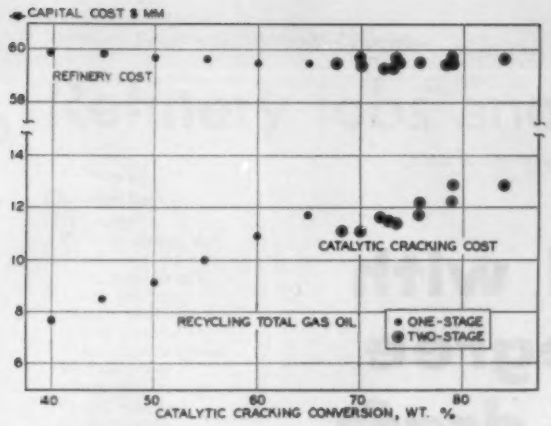
*Includes natural catalyst.

the recycle of total gas oil, and the other of heavy gas oil only. Three cases were two-stage. One assumed the charging of total first-stage oil into the second stage, followed by recycle of total gas oil in the second stage. The other two assumed the charging of heavy gas oil only to the second stage, withdrawing first-stage light gas oil for No. 2 fuel oil sales. Of the latter two, one assumed the recycle in the second stage of total gas oil and the other of heavy gas oil only. For each of the five modes of operation, a number of cases were chosen from the previously described program, in an attempt to supply the most attractive cases over a range of conversion levels. In this manner, approximately 60 catalytic cracking cases were examined in the model refinery.

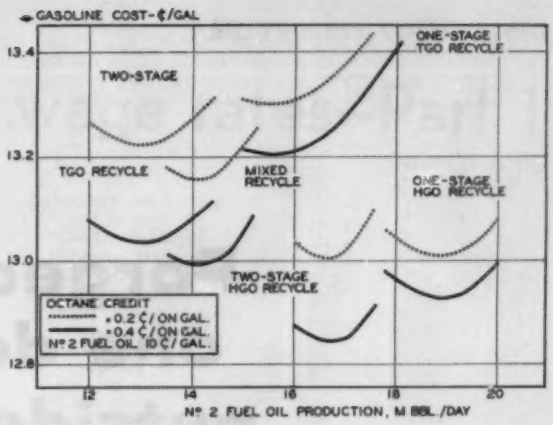
Fig. 4 shows the capital costs, for the catalytic cracking unit and for the refinery as a whole, plotted against catalytic cracking conversion. The cost of the catalytic cracking unit increases rapidly with conversion, but because of the resulting increased gasoline yield and decreased crude intake the refinery cost decreases. The effect of using two-stage cracking is a slight decrease in capital, both in the unit itself and in the refinery.

As may be expected, the economic comparison depended mostly on the amount of No. 2 fuel oil made and its assigned value, and also to a major extent upon the credit taken for the octane number of the gasoline. When gasoline cost was plotted against catalytic cracking conversion, it was found that at conversions below 60% single-stage cracking was usually most profitable, but that at conversions of about 65% or higher two-stage cracking was preferable. The conversion at which gasoline cost was lowest depended upon the value taken for No. 2 fuel oil. With this product at 10 cents per gallon, the optimum conversion was in the range 60 to 70%, and single-stage and two-stage were about equally profitable, whereas at 8 cents per gallon, the optimum conversion was over 70%, which is definitely in the two-stage region.

A graphical description of the results of the study is given in Fig. 5. Since, in general, the demand for No. 2 fuel oil is an important criterion in controlling refinery operation, it is desirable to plot gasoline cost against refinery production of this material. An advantage of this type of plot is that at any given production rate of No. 2 fuel oil the relative economics of the various processes does not depend upon No. 2 fuel-oil price. The result of the study, when looked at in this way, is that at a high fuel-oil pro-




**CAPITAL COSTS** for the catalytic cracking unit and for the refinery as a whole, plotted against cat cracking conversion. Fig. 4.




**EFFECT** of No. 2 fuel-oil production of gasoline cost for 30,000 bbl. per calendar day. Capital amortization, 30% per year. Fig. 5.

**TABLE 5—FEED PREPARATION DATA FOR COMMERCIAL TWO-STAGE CATALYTIC CRACKING**

| Type of feed stock: | Alberta I | Alberta II | Ventura I | Ventura II | Four Corners I |
|---|---|---|---|---|---|
| Crude mixture, vol. %: | | | | | |
| Britamoil (Alberta) | 51 | 62 | 8 | 0 | 0 |
| Texas Co. (Alberta) | 15 | 17 | 0 | 0 | 0 |
| Pembina (Alberta) | 24 | 21 | 3 | 0 | 2 |
| Calif. Valley heavy distillates | 10 | 0 | 0 | 0 | 0 |
| Ventura (California) | 0 | 0 | 89 | 100 | 0 |
| Four Corners | 0 | 0 | 0 | 0 | 95 |
| Cat. cracker feed composition, vol. %: | | | | | |
| Straightrun heavy gas oil | 7.0 | 17.3 | 0.0 | 0.0 | 16.6 |
| Straightrun extra-heavy gas oil | 18.7 | 14.7 | 16.1 | 18.5 | 22.5 |
| Heavy flashed distillates | 57.1 | 40.9 | 29.6 | 30.8 | 40.1 |
| Deasphalted oil | 17.2 | 11.8 | 0.0 | 26.3 | 12.3 |
| Mixed stocks from storage | 0.0 | 15.3 | 54.3 | 24.4 | 8.5 |
| Asphalt properties: | | | | | |
| Specific gravity | ... | 1.04 | 1.07 | 1.07 | 1.08 |
| Softening point, °F. | ... | 157 | 206 | 201 | 223 |
| Penetration at 115° F. | ... | 9 | 7 | 7 | 3 |

**TABLE 6—SUMMARY OF ECONOMICS**

| | | | | |
|---|---|---|---|---|
| Gasoline production, B/CD | 30,000 | 30,000 | 30,000 | 30,000 |
| No. 2 fuel oil, B/CD | 12,700 | 13,950 | 16,650 | 18,750 |
| Preferred type of cracking | 2-Stage | 2-Stage | 2-Stage | 1-Stage |
| Recycle pattern | TGO | Comb. | HGO | HGO |
| Combined feed ratio* | 2.1 | 2.0 | 1.9 | 2.4 |
| Conversion† | 79 | 76 | 70 | 60 |
| Capital, $ M.M.: | | | | |
| Cat. cracking‡ | 12.2 | 12.1 | 11.8 | 11.3 |
| Total refinery | 59.6 | 60.0 | 60.7 | 60.2 |
| Gasoline cost, ct./gal.:§¶ | | | | |
| Octane credits at 0.4 ct./O.N. | 13.04 | 12.99 | 12.84 | 12.92 |
| Octane credits at 0.2 ct./O.N. | 13.23 | 13.16 | 13.01 | 13.00 |

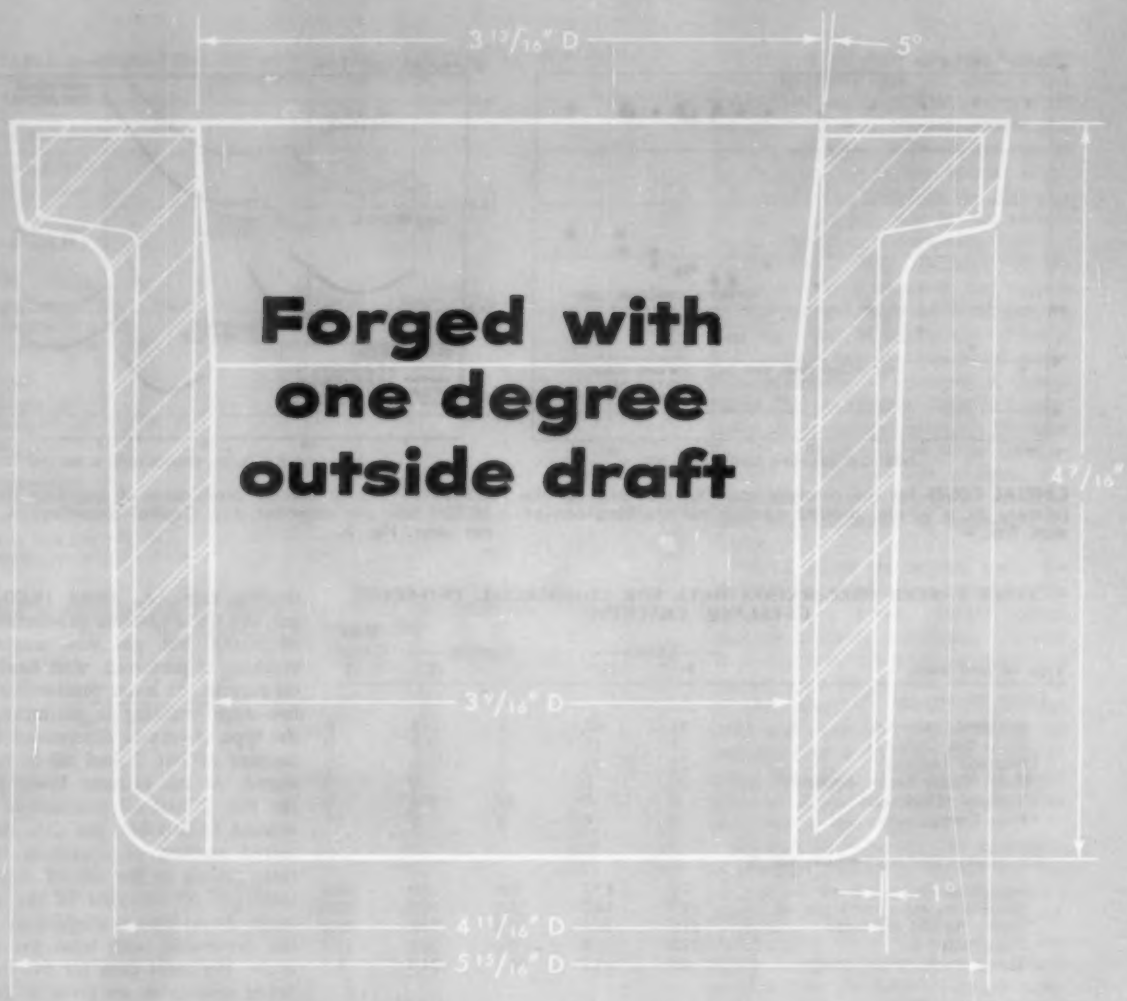
*Volume ratio feed to fresh feed. †100 minutes weight per cent of product boiling over 450° F. cut point. ‡Includes gas plant, but not offsite facilities. §Including capital amortized at 30% per year. ¶Including credits for octane number of pool above research.

"For each of the five modes of operation, a number of cases were chosen . . . to supply the most attractive cases over a range of conversion levels."

duction rate, i.e., about 18,000 bbl. per day for a gasoline production rate of 30,000 bbl. per day, single-stage cracking is preferred, with heavy-gas-oil recycle. At lower production rates, two-stage cracking is preferred, with the type of recycle determined by the amount of No. 2 fuel oil to be produced. At the extreme lower end of the No. 2 fuel oil production range, around 13,000 bbl. per day, the preferred method of operation is with total gas oil to the second stage, and total gas oil recycled in the second stage. At no time is single-stage cracking preferable with total gas oil recycle. Pertinent data for the four favored operations are given in Table 6.

The importance of the credit assigned to octane number is also shown in Fig. 5, where the two arbitrary figures of 0.2 cents and 0.4 cents per research octane number per gallon have been used (at constant sensitivity). The conclusion is that two-stage cracking is favored at the higher rate of credit. Since the cost of octane-number enhancement increases as the refinery octane level is increased, this result is interpreted to mean that two-stage cracking will become more profitable as octane levels become higher and more expensive to achieve.

A conclusion to be drawn from this economic study is that two-stage catalytic cracking is compatible with today's major trends in petroleum refining toward increasing gasoline yield and quality. These trends have had the effect of forcing catalytic cracking unit conversions upward, and recycle has become an effective and profitable means for doing this. Recycle alone, however, is not as effective as two-stage cracking, and the studies with the model refinery show the latter to be profitable at high gasoline to distillate fuel ratios.

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**BETHLEHEM STEEL**

BETHLEHEM STEEL

BY W. L. NELSON
Technical Editor and Petroleum Consultant



# Refinery jobs and wage rates—Part 1

| Category— | Ratio to avg. wage of workers* |
|---|---|
| **Administration:** | |
| †President | |
| †V.p. in charge mfr. | |
| †Tech. asst. to v.p. | |
| †Gen. mgr. to mfr. | |
| †Asst. gen. mgr. | |
| †Senior staff engineer | |
| †Chief process mgr. | |
| †Asst. chief engineer | |
| †Refinery mgr. | |
| †Tech. asst. to mgr. | |
| †Legal counsel | |
| †Superintendent | |
| †Asst. supt. | |
| †Secretaries | |
| †Stenographers | 0.744-[1] |
| **Accounting:** | |
| †Office mgr. | 0.923-[1] |
| †Chief accountant | |
| †Chief clerk | |
| †Cost accountants | |
| †Economics engineers | |
| †Payroll accountants | |
| †Cashier | |
| †Paymaster (payroll supervisor) | |
| †Timekeeper | |
| †Clerks | 0.56(0.46-0.66)-[1] |
| †Typists | |
| †Telephone operator | |
| **Purchasing and Sales:** | |
| †Shipping dept. supervisor | |
| †Stock dept. supervisor | |
| †Purchasing agent | |
| †Buyers | |
| **Technical Services Management:** | |
| †Mgr. of technical service | |
| †Technical director | |
| †Asst. to tech. director | |
| †Director of research | |
| †Asst. to research director | |
| †Secretaries | |
| †Clerks | |
| †Engineering consultants | |
| **Engineering:** | |
| †Chief mechanical engr. | |
| †Mechanical engineers | |
| †Chief elec. engineer | |
| †Electrical engineers | |
| †Civil engineers | |
| Transit man | |
| Rodman | |
| †Structural engineers | |
| †Maintenance engineers | |
| †Design engineers | |
| †Safety engineer | |
| †Head draftsman | |
| †Draftsmen | |
| †Chief process engineer | 3.10 |
| †Process engr.—crude | 1.95 |
| †Process engr.—distillation | 1.95 |
| †Process engr.—coker | 1.95 |
| †Process engr.—cracking units | 2.00 |
| †Process engr.—alkylation | 2.00 |
| †Process engr.—solvent extrac. | 2.00 |
| †Process engr.—polymers | 1.95 |
| †Process engr.—treating | 1.90 |
| †Process engr.—dewaxing | 2.00 |
| †Process engr.—reforming | 2.00 |
| †Process engr.—asphalt | 1.90 |
| †Process engr.—gas plant | 1.90 |
| †Instrument specialist | |
| †Junior process engineers | 1.25 |

| Category— | Ratio to avg. wage of workers* |
|---|---|
| **Laboratory and Testing:** | |
| †Chief chemist | |
| †Chief technologist | |
| †Chemist, petroleum | 1.37-[1] |
| †Chemist, special testing | 1.22-[1] |
| †Chemist, research | |
| †Asst. research chemists | |
| †Consulting chemist | |
| †Metallurgist | |
| Group leaders | |
| Column man | |
| †Glass blower | |
| Crude-column operator | |
| †Engine operator | |
| †Test-engine operator | |
| †Podbielniak operator | |
| Laboratory testers | |
| Research technician, first class | 1.09-[1] |
| Research technician, second class | 1.03-[1] |
| Special tester, senior | 1.05(1.01-1.07)-[2] |
| Special tester, junior | 1.00(0.99-1.02)-[2] |
| Routine testers | 0.95(0.77-1.01)-[10] |
| Tester helpers | 0.93(0.91-0.95)-[2] |
| Maintenance helpers | 0.92-[1] |
| Samplers, bottle washers | 0.90(0.86-0.94)-[2] |
| †Stenographers | |
| †Clerks | |
| Sample storekeeper | |
| †Pilot-plant operator | |
| **Manufacture Management:** | |
| †Mgr. of operations | |
| †Night superintendent | |
| †Director of operations | |
| †Secretaries | |
| †Area supervisors | |
| General foreman | |
| Asst. general foreman | |
| †Manager, distilling | |
| †Manager, lube oils | |
| †Manager, asphalt | |
| †Manager, cracking | |
| †Manager, utilities | |
| †Manager, compounding | |
| †Manager, water plant | |
| Shift foreman | |
| **Manufacture:** | |
| Chief operator | 1.26-[2] |
| Process unit foreman | 1.125-[1] |
| crude | |
| coker | |
| cat cracking | |
| viscosity breaking | |
| vacuum stills | |
| gas conc. | |
| alkylation | |
| polymerization | |
| reforming | |
| Shift foreman | |
| Crude unit— | |
| Operators (stillman) | 1.14(1.05-1.22)-[13] |
| Asst. op.—first helper | 1.05(1.04-1.10)-[10] |
| Firemen | 0.99(0.96-1.04)-[8] |
| Houseman | 1.02-[2] |
| Helper—second | 1.03(1.01-1.05)-[5] |
| Helper—third | 0.97(0.94-1.00)-[3] |
| Top man | |
| Batch-still stillman | 1.09-[1] |
| Cracking still— | |
| Operators (stillman) | 1.16(1.13-1.23)-[11] |
| Asst. operator | 1.09(1.05-1.14)-[10] |
| Op. helpers | 1.04(1.01-1.07)-[5] |
| Fireman | 1.04(0.98-1.16)-[9] |
| Houseman | 1.04(1.0-1.07)-[3] |
| Helpers | 0.97(0.94-1.01)-[2] |
| Tar level man | |
| Stillman-pressure | |

**Refinery Jobs and Wage Rates (Continued)**

| Category— | Ratio to avg. wage of workers* |
|---|---|
| **Manufacture (cont.):** | |
| Still, low-press. | ..... |
| Blower operator | ..... |
| General distillation— | |
| Rerun stillman | 1.10-[1] |
| Rerun houseman | 1.02-[1] |
| Atmos. and vacuum | ..... |
| Lube stillman | 1.09(1.09-1.10)-[1] |
| Lube houseman or asst. | 1.03(1.02-1.05)-[2] |
| Tower man | ..... |
| Combination units— | |
| Operator | 1.16-[2] |
| Asst. operator | 1.10-[2] |
| Fireman | 1.03-[2] |
| Gas plant— | |
| Engineer | 1.10-[1] |
| Operator (stillman) | ..... |
| Compress. operator | ..... |
| Compress. helper | ..... |
| Vacuum valve repairman | 1.02-[2] |
| Debutanization fireman | ..... |
| Stabilized operator | ..... |
| Stabilized helper | 0.95-[1] |
| Alkylation— | |
| Operator | 1.16-[1] |
| First helper | 1.07-[1] |
| Polymerization— | |
| Operator | 1.09(1.01-1.16)-[3] |
| First helper | 1.06(1.05-1.07)-[2] |
| Reactor cleaner | 0.99-[1] |
| Cata. mixer | 0.88-[1] |
| Cata. reformer— | |
| Operator | 1.08(1.03-1.13)-[2] |
| First helper | 1.05-[1] |
| Utility helper | 0.94-[1] |
| Dehydrogenation— | |
| Foreman | ..... |
| Operator | ..... |
| Reactor operator | ..... |
| Reactor helper | ..... |
| Treating, light oil— | |
| Treaters | 1.04(0.91-1.11)-[10] |
| Helpers | 1.04(1.03-1.06)-[4] |
| Blender | ..... |
| Ethyl blender | 1.22-[1] |
| Sludge separator | ..... |
| Lead recovery man | ..... |
| Blower helper | ..... |
| Acid treating, heavy oil— | |
| Treater | 1.12(1.10-1.15)-[3] |
| First helper | 1.04(1.02-1.06)-[3] |
| Second helper | 0.97-[1] |
| Blower operator | ..... |
| Acid recovery— | |
| Contractor operator | ..... |
| Sludge operator | ..... |
| Retort operator | ..... |
| Retort helper | ..... |
| Mixer | ..... |
| Deasph. and propane acid treating— | |
| Operator | 1.16-[1] |
| Asst. op. | 1.07-[1] |
| First helper | 1.03-[1] |
| Second helper | 1.0-[1] |
| Solvent ext. or dewax.— | |
| Operator (treater) | 1.12(1.10-1.13)-[2] |
| Asst. op. | 1.07(1.05-1.07)-[2] |
| First helper | 1.04(1.03-1.06)-[2] |
| Engine man | 1.03-[1] |
| Houseman | 1.03-[1] |
| Pumper or helper | 1.00-[2] |
| Coil cleaner | 0.88-[1] |
| Edleanu treater | ..... |
| Phenol treater | ..... |
| Contact plant— | |
| Operator (treater) | 1.10-[1] |
| First helper | 1.03-[1] |
| Press man (operator) | 0.97-[1] |
| Clay man | 0.92-[1] |
| Clay, car unloader | 0.88-[1] |
| Blanket repairman | 0.92-[1] |
| Blanket helper | 0.86-[1] |
| Precoat filter— | |
| Operator (treater) | 1.10-[1] |
| First helper | 1.03-[1] |
| Second helper | 0.97-[1] |
| Filter plant (percolation)— | |
| Operator | 1.05(0.98-1.10)-[4] |
| Top man | 1.03-[1] |
| Washer | 1.00-[1] |
| Third helper | 0.96(0.95-0.97)-[2] |
| Fourth helper | 0.96-[1] |
| Maintenance | 1.00-[1] |
| Clay roaster and loader | 1.05-[1] |
| Paraffin plant— | |
| Refrigeration engineer | 1.09-[1] |
| Engineer or asst. | 1.07(1.03-1.10)-[2] |
| Operators | 1.04-[2] |
| Operators helper | 1.03-[1] |
| Sweater man | ..... |
| Sweater pumper | 1.00(0.98-1.03)-[2] |
| Sweater helper | 1.00-[1] |
| Press operator | 1.02(1.00-1.04)-[2] |
| Press dumper | 0.95(0.91-0.99)-[5] |
| Blanket repairman | 0.95(0.92-0.98)-[2] |
| Utility man | 1.03-[1] |
| Canvas fabricator | 0.96-[1] |
| Repulper | 1.02-[1] |
| Centrifuge dewaxing— | |
| Foreman | 1.09-[1] |
| Chiller man | 1.08-[2] |
| Operator | 1.05(1.01-1.10)-[3] |
| Machine man | 1.03-[1] |
| First helper | 1.00-[1] |
| Second helper or pumper | 0.98-[2] |
| Utility man | 0.97-[1] |
| Wax finishing— | |
| Treater | ..... |
| Roll operator | 1.01-[1] |
| Roll helper | 0.93-[1] |
| Trucker and packer | 0.88-[1] |
| Molder | 1.01-[1] |
| Molder helper and packer | 0.88-[1] |
| Compounding and canning— | |
| Special compounder | 1.13-[2] |
| Compounder | 1.06(1.03-1.10)-[4] |
| Compounder helper | 1.02(1.01-1.03)-[2] |
| Barrel filler | 0.92-[1] |
| Barrel filler helper | ..... |
| Can filler | ..... |
| Floorman | 1.03-[1] |
| Checker or pumper | 1.01-[1] |
| Drum filter operator | 1.00-[1] |
| Stenciler | 0.97-[1] |
| Stenciler helper | 0.92-[1] |
| Machine man | 1.00-[1] |
| Caser | 0.97-[1] |
| Carton filler or laborer | 0.85-[1] |
| Chemical cleaning— | |
| First helper | 1.04-[1] |
| Second helper | 1.00-[1] |
| Still cleaner | 0.98-[1] |
| Still cleaner (no trays) | 0.97-[1] |
| Tank or third helper | 0.91-[1] |
| Sewer or cooling tower | 0.87-[1] |
| Separator pumper | 1.00-[1] |
| **Pump House:** | |
| Pumper or special pumper | 1.08(1.07-1.10)-[4] |
| Pumper or helper | 0.97(0.77-1.05)-[5] |
| Pumper, night | 0.92-[1] |
| Water pumper | 0.86-[1] |
| Waste oil pumper | 0.91(0.89-0.94)-[2] |
| Senior gager | 1.04(1.02-1.06)-[2] |
| Gager | 0.98(0.89-1.06)-[11] |
| Gager, field | 1.02-[1] |
| Gager, pipeline | 0.95(0.92-0.98)-[2] |
| Dam man | ..... |
| Line walker | 0.86-[1] |

*Numbers in brackets indicate the number of refineries reported. †Usually salaried employes.

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On the Job

PIPELINING

Trans-Arabian ran into a lot of headaches while . . .

# Fighting corrosion in the desert

**Corrosion mitigation on the 30/31-in. Trans-Arabian Pipe Line, completed in October 1950, is complicated and difficult because the pipe is exposed to varied corrosive conditions.**

BY F. M. MAASRY
Trans-Arabian Pipe Line Co.

THE above-ground portion of the Trans-Arabian pipeline lies entirely in Saudi Arabia and has hundreds of buried sections scattered along its length.

The buried sections range from 30-ft. crossings for camels to stretches of several miles in low areas. These buried sections of the line encounter many kinds of soils ranging from those of the dry desert with resistivities running up to hundreds of thousands ohm-cm. to clays and loams as low as 800 ohm-cm.

### Existing Treatment

All buried sections of the main line were given a P-2A treatment—an application of a standard petrolastic primer followed by a coat of asphalt, a glass fiber floss, a second coat of asphalt, and an outer wrapper of asbestos felt. In rocky areas, heavy asbestos-felt rock shield was used as a supplementary protection against rocks in the bottom of the ditch.

Subsequent inspections, however, revealed much of the pipe coating on the line to be of only fair quality. This is due to three major causes.

1. The type of asphalt used could not resist the soil stresses exerted on it in the clayish Khubra regions of Jordan. The soil in these regions has a tendency to dry up and shrink appreciably in the dry season, thus exerting a tremendous stress which pulls from the pipe surface the asphaltic treatment on it.

2. Improper application of the treatment resulted in an uneven spray of dope around the pipe. Usually when a spray nozzle on the doping machine missed, especially on the side away from the inspector, it was not discovered until the machine had traveled for quite some distance on the pipe. The glass floss and the paper wrap concealed these areas and later prevented the cathodic-protection current from stopping any corrosion activity underneath.

3. Inadequate bonding between the steel pipe and coating existed along a major portion of the buried line. Poor bond apparently resulted more often from dead primer than from an accumulation of dust or foreign matter on the primed pipe, although signs of both are encountered.

Five years after cathodic protection had been continuously applied, a section of the main line, where pipe-to-soil potential was found appreciably lower than adjoining sections, was excavated and the coating inspected. Outwardly the coating appeared in good condition, with no evident holidays.

However, stripping sections of the coating revealed no bond and considerable moisture between the line and coating for about 100 ft. Liquid would gather and drip out at the bottom of the strip points. A sample of this brown liquid was found to be a basic solution containing 17% sodium carbonate with a pH value of 11.5.

Some areas between coating and line contained a white deposit; crystals, apparently of the same substance, were found near the bottom. No rust or corrosion products were evident. The average pipe-to-soil potential was 1,200 mv.

The backfill on the line in the volcanic and mountainous areas of Jordan, Syria, and Lebanon is rocky. The coating conductivity varies considerably along the pipeline from as low as 10 micromhos per sq. ft. to several hundred micromhos.

### Corrosion Control

The cathodic-protection program for the Trans-Arabian Pipe Line system was started as soon as the pipe was laid in the ground.

From Qaisumah, Tapline's first pump station, to Turaif, the last pump station in Saudi Arabia, the line is above ground except for 133.19 miles of scattered buried sections of 30 ft. to several miles in length. The entire section of 245.72 miles between Turaif and the Sidon Terminal is buried.

The protection program originally called for the installation of rectifiers in the four pump stations and the Sidon terminal, and of magnesium anodes on the intermediate sections.

Protection achieved from the 100-volt, 70-amp. pump station recifiers was soon found to be considerably more limited than early surveys indicated. The magnesium program on the short buried sections in high-resistivity soils was generally found to be inadequate. The constant increase in current requirement was due to progressive settling of backfill around the pipe and deterioration of the pipe coating. It soon necessitated the establishment of cathodic-protection stations at shorter intervals along the line.

Power is not available along the line except from the pump stations and Sidon Terminal. A power line along the entire length of the line would have involved a great deal of unnecessary expense. Diesel-driven generators were found to be the most economical source of current for the cathodic protection of Tapline.

The effort was first directed at protecting the continuously buried section between Turaif and Sidon, a distance of 245.72 miles. The line goes through soft soil in Arabia and part of Syria, lava in Jordan and part of Syria, and rocky soil in Lebanon and the balance of Syria. Coating conductivities run high along this section, and the coating is extensively damaged by rock.

The most economical spacing between cathodic-protection stations, assuming an average coating conductivity of 250 micromhos per sq. ft. and using the Finite Line equation[1], was found to be 11 miles. This spacing would normally limit the potential at the drain point to 3 volts.

At present, the pipeline between Turaif and Sidon is protected from rectifier installations in Turaif, Qaryatain, and Sidon, and 16 intermediate unattended diesel-driven genera-

Presented at First Arab Petroleum Congress, Cairo.

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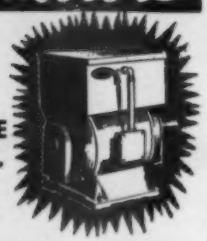

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tor stations. The ground beds almost all require watering during the dry season. Water must be hauled up to 62 miles.

### Unattended Stations

The generators used in the unattended cathodic-protection stations are Dornhoff generators connected directly to Deutz diesel engines. Each generator is rated at 6.5 kw. and is capable of continuous operation at as low as 40% of its rated voltage. New generators are equipped with a 12-volt dynamo for field excitation to render the generator capable of operating at outputs ranging from 65 amp. at 100 volts to 162 amp. at 40 volts. This meets the variable current requirements from summer to winter as well as from location to location.

The lubricating facilities provided on the engine did not permit the contemplated 4-day operation of the engine. The capacity of the oil pan in the crankcase is not sufficient for 4 days continuous service, and the valve rockers and valve guides in the cylinder head had to be lubricated by hand every day through a two-lid oiler mounted on the cylinder-head cap.

To overcome these obstacles, an additional oil vessel was fitted and connected with a flexible tube to the oil pan. The oil was made to flow from the additional vessel to the oil pan and thus be sufficient for 4 days operation.

Likewise, an extra vessel containing lubricating oil for the valve rockers and valve guides was mounted on the wall with flexible connection to the lubricating nipples on the cylinder head cap. With these alterations made, the engines are now running for 4 days without any attendance.

No. 2 diesel fuel was used on the engine-generator units installed during 1952 in Syria and Jordan. Only a few modifications were required from the manufacturer for crude oil operation.

Engines now received in the field are equipped with special dual-fuel filters, fuel-feed pumps, pistons with cast-iron insert and chrome compression rings, and other minor features required for satisfactory crude-oil operation. With the exception of four unattended cathodic-protection stations in Syria, all the Deutz engines along Tapline now operate on crude oil tapped directly from the main line into a storage tank in each unattended cathodic-protection station.

The units are operated alternately after every service. This arrangement makes it difficult to provide a detailed operating record of any single unit. Nevertheless, the availability of a spare unit has the advantage of assuring over 90% time operation of the cathodic protection-station. Recently d.c. ampere chart recorders were installed in all unattended cathodic-protection stations to record exact operation time.

### Corrosion Control on the Short Buried Sections

The short buried sections of line between Qaisumah and Turaif were inadequately protected by magnesium-anode installations.

In February 1955, Tapline experienced its first corrosion leak on the main line. The leak occurred on a buried section about 1,600 ft. long. Two other leaks followed in October and November of the same year, also in similar short buried sections.

Unattended cathodic-protection stations with engine-generator sets were then installed to protect the underground sections of the line in Saudi Arabia. Ten such stations are now in operation.

However, cathodic protection cannot be fully effective in areas of shielded corrosion. Corrosion activity under glass floss and a wrapper of asbestos felt was observed in a great many instances on the short buried sections in Saudi Arabia. This corrosion cannot be stopped by cathodic protection. So, we, in Tapline, are undertaking an extensive program of pipeline reconditioning where we excavate, clean the existing treatment, and rewrap the line with pressure-sensitive plastic tape.

### Pump Stations

Numerous leaks occurred on the control and instrument lines in the pump stations. These lines had been receiving partial protection from the 100-volt, 70-amp. rectifier at each station. The current drained had not been sufficient to provide complete protection.

The principal areas of low pipe-to-soil potential were in the vicinity of the scraper traps and close to the pump house where all the instrument lines are located. Complete protection from a remote anode is usually uneconomical in such cases because:

1. There is a large area of bare steel in contact with the soil, and
2. The soil resistivities in these areas are too high to permit sufficient pro-

full SCOPE of
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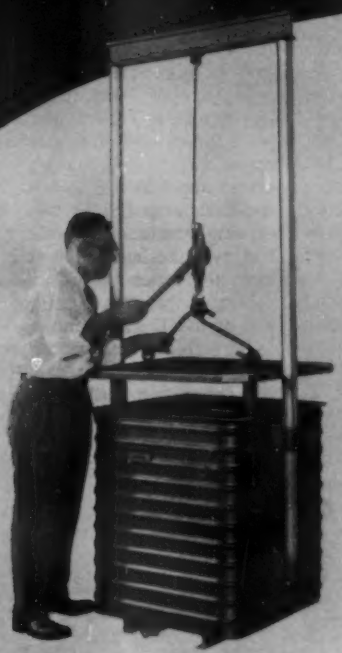

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**400-ampere oil-immersed contactor available in Type H front access controllers for indoor, outdoor, or Division 2 service.**

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Now, from Allis-Chalmers, comes the most complete line of motor control ever developed for the chemical and petroleum industries. With the addition of an all-new line of oil-immersed controllers and contactors, you can select just the right control — oil or air — to meet your needs. Ratings are to 1500 hp at 2200 volts; 2500 hp at 4000-5000 volts.

**For divisions 1 and 2** (hazardous and semi-hazardous locations) or corrosive atmospheres: A-C offers 400-ampere, 50-mva oil-immersed controllers with floor-mounted lift-out or frame-mounted tank-lowering construction. Load-break disconnect switches optional.

**Type H front access controllers** with current-limiting fuses are available where higher interrupting capacities are required. Type H units are available with oil-immersed contactors for semi-hazardous areas and other applications; air-break contactors for non-hazardous areas.

Type H controllers can be specified with *Shelter-Clad* walk-in, outdoor enclosure for complete protection of personnel and equipment. With this simple, all-steel design you can eliminate expensive, permanent buildings.

**For full details** on the complete line of A-C motor control, either high or low voltage, contact the A-C office near you, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

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## On the Job

PIPELINING

tective current to be drained from the piping.

Supplementary protection was provided by two 100-volt, 25-amp. rectifiers connected to a number of graphite anodes distributed over all the low-potential areas and at a distance not more than 20 ft. from the piping being protected.

The original marine system was constructed in 1950, and consisted of four loading berths with a crude line and a bunkering line connecting to each berth. The lines were wrapped with an asphalt P-24 treatment and covered with asbestos-felt rock shield before laying. The lines are buried along the shore from a manifold at the shore control house to the points where they take off to their respective berths.

In August 1951 an additional submarine system was constructed for a No. 5 berth south of the original installations. The two lines were laid in about the same arrangement as the earlier systems, but the submerged portions were not given any external treatment.

Cathodic protection was applied to the submarine lines by four 20-volt, 250-amp. rectifiers for berths 1 to 4, and by a 15-volt, 200 amp. rectifier for berth No. 5. Each of the rectifiers was connected to a steel-rail anode 600 ft. long consisting of two lengths of 45-lb. rail welded together. Each anode lasts 3 years. An average 150 amp. is applied to each berth.

In October 1956 ten 3 by 60-in. Duriron anodes were installed to replace the deteriorating steel anode for berth No. 5. The anodes were connected together by a 4/0 cable and laid parallel and 20 ft. away from the existing steel anode. Grout bags were laid over the lead cable as it emerges from the water towards the shore to protect it from wave action. The output of the Duriron anodes was satisfactory. However, we are now using lead alloy anodes in cable form for our submarine berths. The lead alloy anode has the advantages of being (1) easier to install, and (2) less susceptible to breakage.

All other marine facilities, such as the barge, tugs, buoys, and pier are protected with magnesium and aluminum anodes.

### References


[1]Ballou, Howell, Lilijeberg and Offerman, "Proposed Alternative Method for Determining Electrical Resistance of Pipe Line Coatings." Corrosion, 7, 438-40, 1951.

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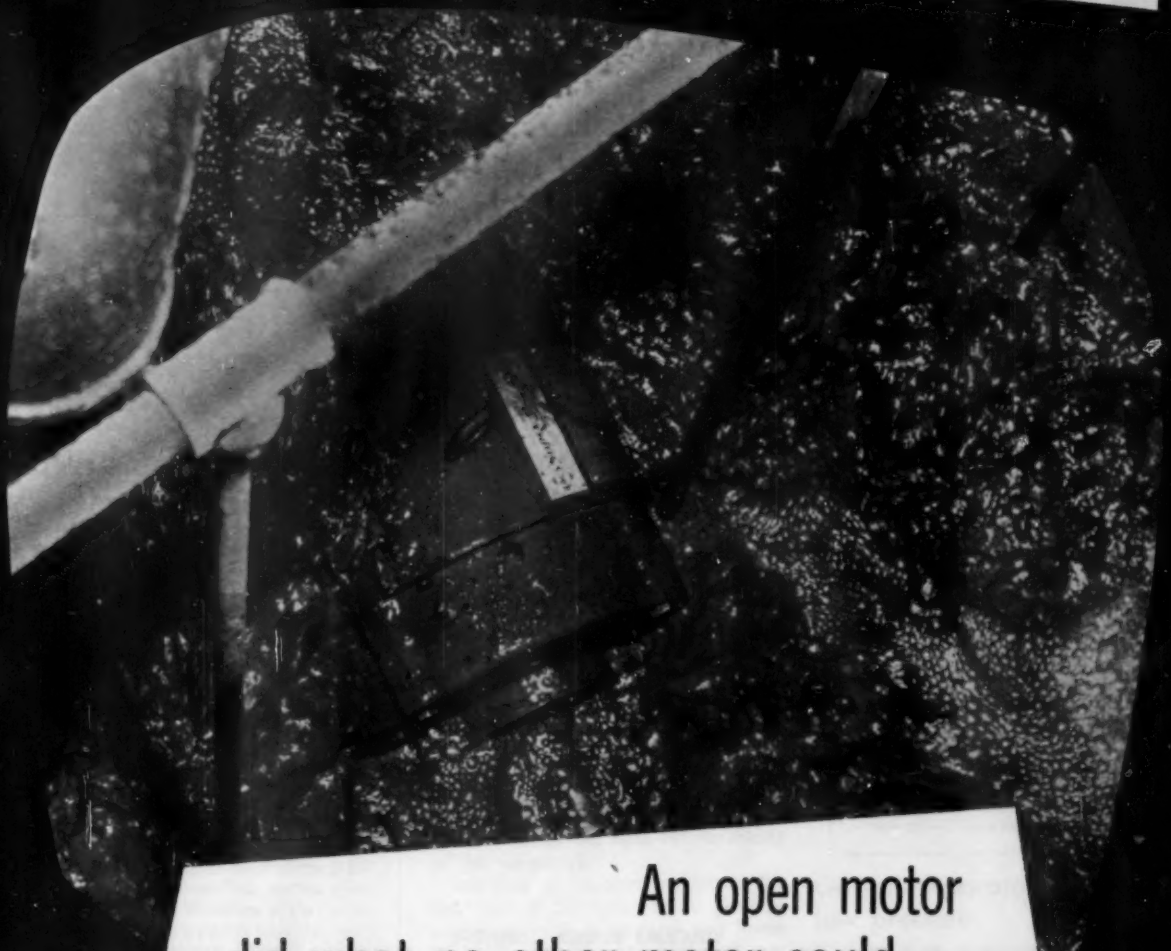

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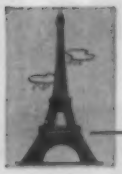

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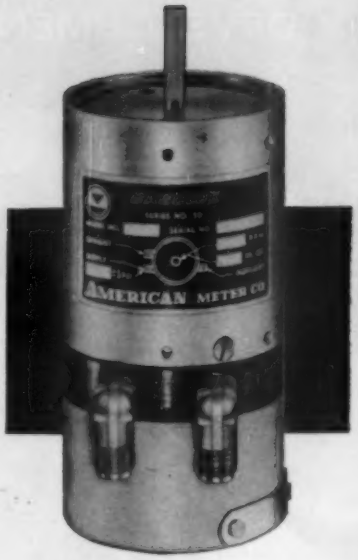


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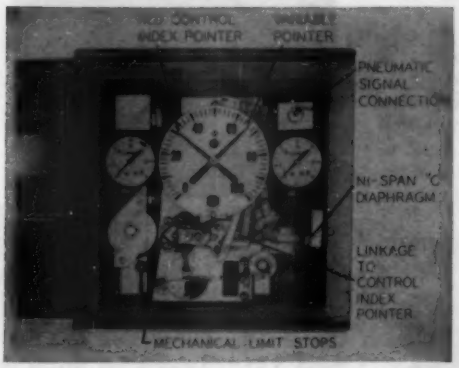
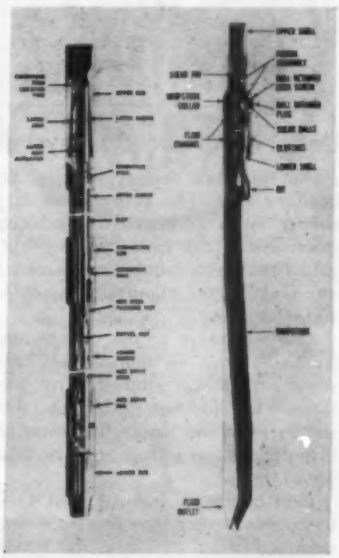



## Pneumatic set-point adjustment

. . . is now optional on U. S. Gauge indicating controllers. It permits positioning of the controller's set point by a 3 to 15-psi. pneumatic signal.

Potential applications include those where the controller is remotely located and the user wants to adjust the set point from a centralized control panel by a manual pneumatic loading station. Applications also include those where the process characteristics require cascade control with a primary controller pneumatically adjusting the set point of a secondary controller.

The controller is available with measuring elements for temperature, pressure, liquid level, or flow. **Contact Manufacturer: U. S. Gauge Div., American Machine & Metals, Inc., Sellersville, Pa., for details on pneumatic controller set-point adjustment.**



## Directional drilling tools

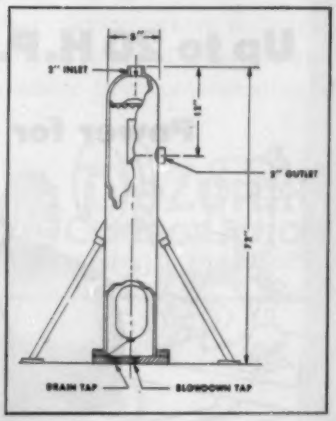
. . . recently developed consist of a mechanical orienting tool and a whipstock. The tools complement each other in orienting whipstocks and in the setting of whipstocks.

The orienting tool is designed to orient whipstocks and deflecting tools without the use of instruments. The other tool allows sediment to be circulated out of the hole before setting of the whipstock.

All that is required to locate the low side of the hole and to position deflecting tools is to raise and lower the drill pipe. The orienting tool employs a ball in a ball race. Gravity pulls the ball to the low side of the hole. A slot allows ample ball-travel distance for identification on the surface.

The drill pipe is raised, lowered, and rotated until the ball falls into the slot. This allows the tool to close and indicates the slot is at the low side of the hole.

Correct positioning of the deflecting tool, before raising, lowering, and rotation of the drill pipe, is achieved by adjusting its face with respect to the slot. This locates the low side of the hole. **Contact Manufacturer: Houston Oil Field Material Co., P. O. Box 18245, Houston, for details on orienting tool and whipstock.**




## Gas-oil separator for low pressure

. . . from 0 to 600 psig. promises an unusually high degree of liquid recovery throughout its operating range. The only moving part of the Type LGV2-600 vertical separator is the float assembly. If replacement is ever

**Send this Showcase Coupon**

**to the Manufacturer of the item in which you are interested. See name, address, and equipment name and/or model, in bold-face type at end of description.**

**NAME AND/OR MODEL NUMBER**.....

.....

**Described in OIL AND GAS JOURNAL · Issue of June 15, 1959**

**NAME**.....**TITLE**.....

**COMPANY**.....

**ADDRESS**.....

**CITY**.....**STATE**.....

needed, the assembly can be changed quickly in the field. Valve-and-seat replacement kits are available.

The stationary separating element consists of a series of vanes and baffles. These guide the oil, water, and gas through the unit. Entrainment is removed by a centrifugal scrubbing action.

A self-contained drainer on the unit permits easy connection to drain pipe for continuous drainage. The separator is code-stamped to the ASME Code for Unfired Pressure Vessels. **Contact Manufacturer: V. D. Anderson Co., 1935 West Ninety-sixth Street, Cleveland 2, for details on Type LGV2-600 separator.**

●

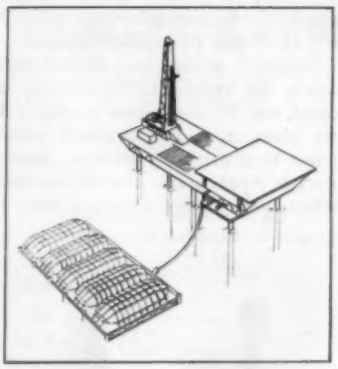
## Lightweight, portable cement mixer

. . . now being produced offers a handy way to mix from 3 to 70 lb. of cement at a time. The mixer comes fully equipped and packaged in the mixing hopper. It is easy to assemble or take apart. The components are made of cast aluminum and require no painting.

Powered by a ⅓-hp. electric motor,

the Pal mixer weighs about 44 lb., including the motor. The hopper lifts out and can be carried to the forms, or to the materials. The mixer sells for about $80, f.o.b. factory. **Contact Manufacturer: Pal Co., 1216 South Victor, Tulsa 4, for details on Pal cement mixer.**

●



## Underwater storage system

. . . for offshore drilling rigs has just been evolved. The system uses large rubber tanks anchored to the ocean floor. Each tank holds up to 50,000 gal. The tanks can be connected to an underwater manifold to obtain added capacity.

One advantage to the underground storage system is that liquids, now stored in tanks atop drilling platforms, would be protected from storms. And too, under the water less turbulence occurs than from ordinary waves.

Cost estimates indicate that in 40 to 50-ft. water the cost of liquid storage can be cut from the present $40 a barrel to about $25. Another advantage is that the system would give added safety to offshore operations as it would eliminate spilling of oil from platform-storage systems. **Contact Manufacturer: U. S. Rubber Co., 1230 Avenue of the Americas, New York 20, for details on underwater storage system for offshore rigs.**

Up to 20 H.P. Single Phase

Power for remote areas

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"All Weather 40"

OIL COUNTRY MOTORS

Eliminate maintenance and the problem of constant attention by replacing Internal Combustion engines with R&M Single Phase Motors! Sizes above 7½ hp (10, 15, 20 hp) have "cushion start" system as extra-cost option, for reduced current starting. Auxiliary mechanism is externally mounted for simple inspection, even while the motor is running. Motors are fully weatherized against moisture, dirt, heat. *Write for Bulletin 470-OGI*

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MOTOR DIVISION • SPRINGFIELD, OHIO

# International Paints for the OIL INDUSTRY

*Floating Roof Tanks for the storage of gasoline at Stanlow Refinery, Cheshire, England.*

*By courtesy of Shell Refining Company Limited.*

## EPISEAL ALUMINIUM PAINT

In formulating Episeal Aluminium Paint for the oil industry, International have scientifically studied all the destructive influences at work in oil plant. This paint has greater durability than conventional ones, lasts longer because of its epoxide resin base, and forms a hard surface which does not retain dirt. It is particularly suitable for rail tank cars and storage containers.

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# SALT WATER CORROSION YOUR PROBLEM? solve it with DeZurik PLASTIC-COATED VALVES!

DeZurik Eccentric Valves can now be furnished with plastic coatings. The plastic coating greatly increases the corrosion resistance of a cast iron valve at only a slight increase in price.

DeZurik Plastic-Coated Valves are the economical answer for salt water disposal systems and other services where resistance to alkalies, mild acids and neutral salts is required. They are also particularly suited to applications where iron contamination is objectionable.

See the DeZurik representative near you, or write for details.

DeZURIK CORPORATION
SARTELL, MINNESOTA

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MACCO
GAS LIFT
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## MACCO NORMALIZED MANDRELS

For a number of years MACCO has normalized all gas lift mandrels. These mandrels are heated to 1200-1400 degrees temperature for 4 hours. This stress-relieving process reduces concentrated corrosion and electrolysis to a minimum, thereby prolonging the useful life of the mandrel. NO EXTRA CHARGE is made for this service.

Write for additional literature or information.

**MACCO OIL TOOL COMPANY, INC.**

1521 Prince — P. O. Box 7288 — Houston 8, Texas
Phone UN 1-1253

SHOWCASE . . .

# New Equipment

## Portable drilling mast developed

. . . recently is designed to reduce the cost of rigup and transportation of drilling rigs. It is easily carried on two semitrailers and a smaller truck as it breaks down into five sections. It is built for rapid ground assembly at the well site. T-bolts and built-in wedge-lock fasteners are used to permit quick assembly.

The assembled lever-lift mast is raised into position over the well by the rig draw-works. The need for a gin pole has been eliminated. The mast is raised from horizontal to vertical by lever type of legs that push the structure into position. Lower end of the lever legs are pivoted where they fasten to the subbase. At the top where they meet the mast, the lever legs are fitted with rollers that ride the mast as it rises to the vertical. When the mast is up, the lifting legs are locked by an automatic-wedge type of mechanism and become an integral part of the structure.

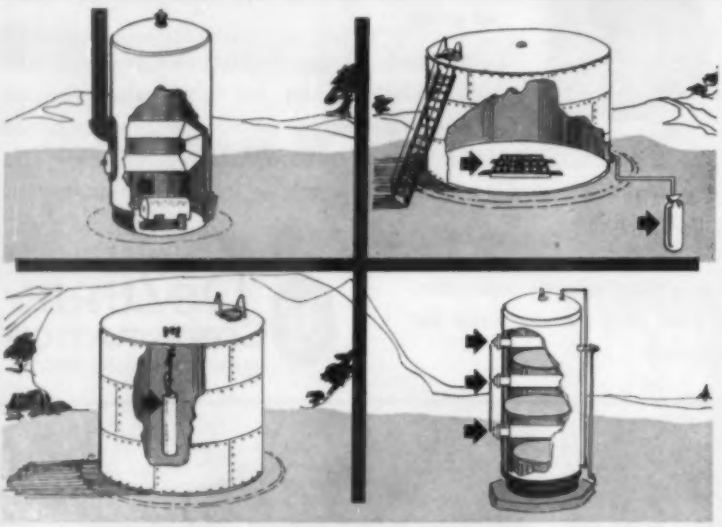
Completely guyless, the mast has a windload capacity of 100 m.p.h. with full pipe rack and pipe setback. Design heights range up to 144 ft. Maximum gross column capacity ranges up to 1,084,000 lb. The mast is rated for drilling depths up to 20,000 ft. **Contact Manufacturer: Oil Well Supply Div., U. S. Steel Corp., P. O. Box 478, Dallas, Tex., for details on Lever-Lift drilling mast.**

●

## Emulsion tester for drilling muds

. . . cements, and fracturing fluids has recently been developed that gives a continuous evaluation of emulsions, whether water in oil or oil in water, plus a reliable indication of emulsion stability. The Model 23-A instrument operates on the principle that an alternating electrical potential tends to break out water-in-oil emulsion. Time stability and resistance to contamination of emulsions can be predicted from a measurement of relative emulsion stability.

The tester is suited for field use. In combination with suitable electronic circuitry, it can be used as the control element of an automatic programer or readout system. **Contact Manufacturer: Fann Instrument Corp., P. O. Box 6101, Houston, for details on Model 23-A emulsion tester.**

HOW TO STOP CORROSION OF TANKS & HEATER TREATERS

Field experience has proved that cathodic protection offers a reliable, low-cost way to stop corrosion on steel tanks, heater treaters, filters and free-water knockouts—both externally and internally. It is effective even on vessels in contact with the most corrosive of oil field brines.

Corrosion is stopped by projecting an electrical current onto the tank surface to be protected—using either magnesium anodes or rectifiers as the current source.

The drawing shows five of the methods by which such protection can be set up. For internal protection, anodes can be suspended from the top; inserted through side openings; or bolted to or set on wooden supports at the bottom. External protection of tank bottoms is usually achieved by burying anodes in the soil near the tank.

CSI engineers are pioneers in this work. They offer expert engineering and installation services, plus a complete line of quality supplies for both rectifier and anode installations. Prices are competitive. Call or write today.

CSI

CORROSION SERVICES INCORPORATED

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1309 Washington Ave.
Tel. CHerry 1-7795

General Office, Tulsa, Okla.
Mailing Address:
Box 787, Sand Springs, Okla.
Tel. Circle 5-1351

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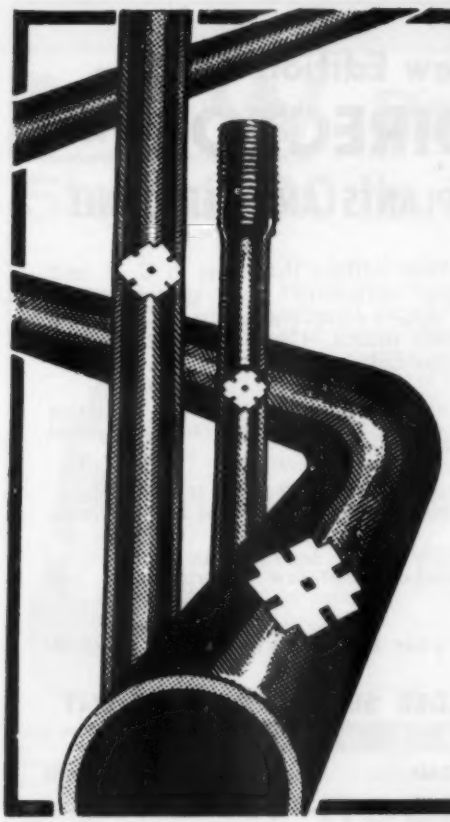

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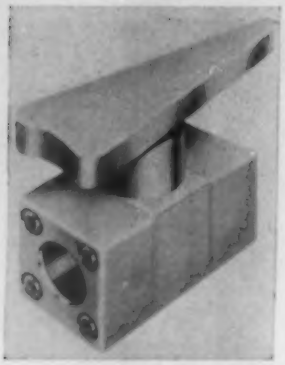
Cable: "SUMITOMOMETAL TOKYO"



## Ball type of plug valve available

. . . for pressures to 3,000 psi. can be used in nonthrottling applications to place conventional needle valves. The valve seals tight and needs only a one-quarter turn to close, as compared to four to six turns required by a needle valve.

Resembling an electric panel switch, the valve is easy to open or close and clicks into place at both ends of the quarter turn.

The valve can be panel, bracket, or line-mounted. It can be used for gage shutoff and with corrosive or other hard-to-handle fluids. A ⅜-in. valve has a 1¼-in. square body, is 2 15/32 in. long, and 1¾ in. high, over-all. **Contact Manufacturer: Hydromatics, Inc., 70 Okner Parkway, Livingston, N. J., for details on Flo ball plug valve.**

●

## Analog computer for chromatographs

. . . has been placed on the market. Analyses can be computed in less than 3 minutes, the maker says. Calculated percentages are accurate to within 0.1%.

The computer corrects peak areas or peak heights for differences in the response of the detector and normalizes the corrected areas or heights to total 100, thereby giving the percent (mole or weight according to correction factors inserted) of each individual component. The Computagram comes in three models to handle up to 12 components.

The computer offers a way to increase the number of analyses completed a day while essentially eliminating analytical errors. **Contact Manufacturer: Podbielniak, Inc., 341 East Ohio Street, Chicago 11, for details on Computagram.**

●

## Corrosion-survey instruments

. . . now available in a 1-in. size with a 1-in. reciprocating type of retriever permit running and recovering the instruments under full line pressure without system shutdown. The Little-Inch instruments are designed primarily for refinery and pipeline applications and permit accurate corrosion detection in many locations, including remote out-of-the-way spots.

The reciprocating retriever is easy to operate. It operates on line pressure under a system of controlled unbalance. One man can operate it. **Contact Manufacturer: Cosasco Div., Perfect Circle Corp., El Monte, Calif., for details on Little-Inch corrosion survey instruments.**


Oil Loans

ROBERT F. CASHEN, Assistant Vice President
Manager, Petroleum Department

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The 1959-60 edition lists men in U. S. and Canadian refineries and petrochemical plants. Also a complete listing of U. S. field processing plants. Gives more than 7,500 key personnel.

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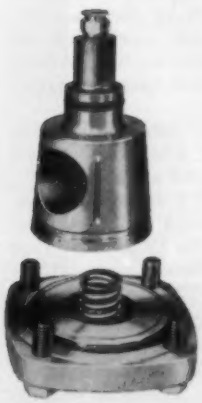
**THE OIL AND GAS JOURNAL**

**Box 1260 . Tulsa, Oklahoma**

# NEW Rockwell-Nordstrom
## Steel 1000-lb. Round Opening Valve . . .



Spring seated plug has full round opening. "O" rings seal to atmosphere and Sealdport® lubricant grooves stop leakage of lightest gases or heaviest fluids.

The new Rockwell-Nordstrom 1000-lb. inverted plug valve is designed to give valve users all the *proven* benefits of lubricated plug valves, plus the advantage of a full round opening in smaller size valves. Here are just a few of the advantages of the new inverted plug valve:

**1. LOW TORQUE:** "O" rings replace conventional packing gland . . . plug is lubricated for easy turning . . . rugged spring maintains perfect seating.

**2. FULL ROUND OPENING:** No cavities . . . minimum pressure drop . . . easy access for scraping.

**3. SIMPLE, RUGGED DESIGN:** Compact dimensions save space, fewer parts mean fewer repairs.

Rockwell-Nordstrom 1000-lb. round opening valves are now available in 2" x 2⅛" size with API line pipe thread for production, pipeline, refinery, marketing, marine and process services; and with external upset threads for Christmas Tree services. Also available in 2" size with flanged ends (300-lb., 600-lb. class). For complete details, see your supplier or send the coupon below. Rockwell Manufacturing Company, Pittsburgh 8, Pa. Canadian Valve Licensee: Peacock Brothers Limited.

*Lubrication makes the difference*

ROCKWELL-Nordstrom VALVES
another fine product by
ROCKWELL

***SEND COUPON FOR COMPLETE DETAILS***

**Rockwell Manufacturing Company**
**Pittsburgh 8, Pa.**

☐ Please send Bulletin V-611 on the new Rockwell-Nordstrom inverted lubricated plug valve.

☐ Please have a Rockwell Field Engineer call me for an appointment.

Name_____ Title_____

Company_____ Address_____

City_____ Zone____ State_____

SHOWCASE . . .

# New Literature

## Fast-locking industrial couplers

. . . for pipe and tubing which achieve tight couplings with only two turns are discussed in a six-page folder, free for the asking. The folder contains pictures and operational data on the following types of couplers: side-outlet tee, 45° elbow, adapter, end plug, side-inlet tee, 90° elbow, cross, and reducer. Two specifications charts are included. **Contact Manufacturer: Ireco, 1300 Bethel Drive, Eugene, Ore., for Fast-Locking Couplers folder.**

## 280-page machinery catalog

. . . discusses various tools, accessories, engines, compressors, pumps, converters, cranes, boilers, and tanks made in England. Catalog 1073 includes photos, descriptions, specifications, and ordering information. **Contact Manufacturer: Thos. W. Ward, Ltd., Albion Works, Sheffield, England, for Albion Machinery Catalog 1073.**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*rugged is the word for this new 90-M!*

Put this new "80" Series pump on the job anywhere . . . this is what you've got! *Amazing performance*, proved time after time. *Higher suction lifts*, and *peak efficiency*, resulting from Gorman-Rupp's patented design. *Fast starts, surer starts* —with high speed repriming. *Dependability*, backed by Gorman-Rupp. Isn't it time you tried one of the new "80" Series Pumps? They're available now.

THE GORMAN-RUPP COMPANY

305 Bowman Street Mansfield, Ohio


## Aircraft bolts for temperatures

. . . up to 1,600° F.—the highest heat-standard fasteners ever offered —are described in new Bulletin 2484. The four-page literature gives photos, charts, and graphs to supplement text, and shows comparative tensile and stress-rupture strengths of bolts fabricated from each of the alloys. Charts show tensile strengths of from 85,000 to 110,000 psi. at 1,600° F. Stress rupture strength for 100 hours is shown as a minimum at 30,000 psi. at 1,500° F. Drawings showing bolt configuration and complete specification data are also given. **Contact Manufacturer: Standard Pressed Steel Co., P. O. Box 790, Jenkintown, Pa., for Bulletin 2484.**

## Air-starting motor brochure

. . . contains case histories on air-starting motor installations, gives information on how to select the proper motor, and lists advantages of the units. The 24-page literature provides detailed specifications and mounting-dimension diagrams for two new units. Drawings show piping arrangements for each size and a suggested hookup for using the motors on vehicles. Brochure 509E features a nine-page selection list showing the size and model number of the air-starting motor required for starting most models of the diesel, gasoline, natural-gas, or dual-fuel engines of 29 motor manufacturers. **Contact Manufacturer: Ingersoll-Rand Co., 11 Broadway, New York City, 4, for Brochure 5094E.**

## Automatic case imprinters

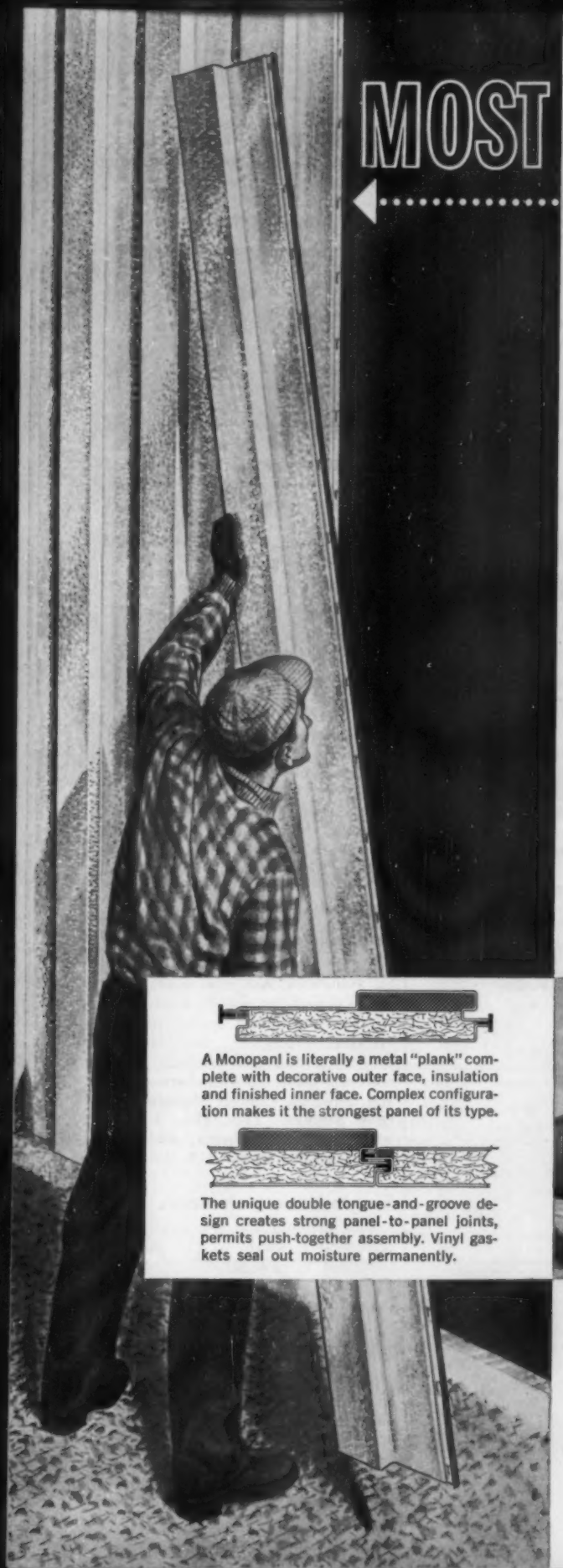
. . . known as Packomatic are outlined in a new, free data sheet. It gives detailed description, dimensions, and a photograph of the case imprinters, which are capable of imprinting from one to four vertical panels of corrugated cases at various speeds.

The sheet also provides type and imprint data and a section outlining information required when submitting a price proposal. **Contact Manufacturer: J. L. Ferguson Co., P. O. Box 1226, Joliet, Ill., for Packomatic Case Imprinters data sheet.**

## Advantages of electric drive

. . . are explained in new obtainable Bulletin GEA-6872. It gives information on reduction of moving and rig-up time, flexibility of locating equipment, positive-drilling control, and maintenance.

The 16-page publication explains drive-system components and offers



# MOST ADVANCED

## insulated curtain wall of its type

## *and it's brand new on Butler buildings*

Here's a fellow that's literally making construction history. In one simple operation he's erecting a complete exterior wall, finished inside and out—fully insulated—and ready for use as installed.

This revolutionary advance in curtain wall construction is made possible with new Butler Monopanl. It is the first factory-fabricated, factory-insulated panel that is factory sized to fit a pre-engineered structural system . . . and it is exclusive on Butler buildings.

Today, even the largest Butler buildings can be enclosed in just days with handsome, slender—space-saving—curtain walls that permanently seal out weather and are equal in insulating ability to thick masonry.

Now, with new Monopanl, the Butler system of building is an even faster, better way to build . . . more than ever, the lowest-cost way to build well.

Call your nearby Butler Builder for full details. Ask him about Butler financing, too. He's listed in the Yellow Pages under "Buildings" or "Steel Buildings." Or write:



A Monopanl is literally a metal "plank" complete with decorative outer face, insulation and finished inner face. Complex configuration makes it the strongest panel of its type.



The unique double tongue-and-groove design creates strong panel-to-panel joints, permits push-together assembly. Vinyl gaskets seal out moisture permanently.

from a design by A. Francik and Associates, Architects

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performance charts showing speed-horsepower and speed-torque curves. **Contact Manufacturer: General Electric Co., Schenectady 5, N. Y., for Bulletin GEA-6872.**

## Diesel engines for oil-field

. . . uses are described in new eight-page Booklet 20169. It summarizes specifications and gives photos of current models. The booklet includes engines for drilling, pipeline construction, and pumping, along with diesel-electric power plants. **Contact Manufacturer: Caterpillar Tractor Co., 600 West Washington Street, Peoria, Ill., for Booklet 20169.**

## Bulletin describes sodium formate

. . . a low-molecular-weight, water-soluble crystalline powder for pH control. The eight-page publication covers product specifications, typical properties, and outstanding characteristics, with particular emphasis on the material's diverse uses.

In secondary recovery, sodium formate has been used for long-range economy during acidizing to moderate the acid's attack on the steel well casing. In calcareous regions, sodium formate-buffered acidizing solution also prevents well clogging. **Contact Manufacturer: Heyden Chemical Div., Heyden Newport Chemical Corp., 342 Madison Avenue, New York City 17, for Sodium Formate bulletin.**


Protect Your Machinery with

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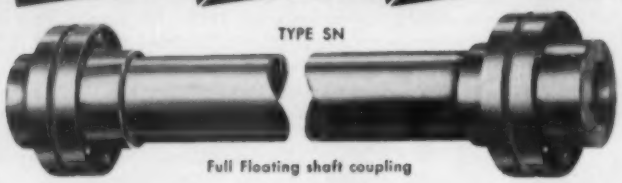
NO LUBRICATION · NO MAINTENANCE · NO WEARING PARTS




Full Floating shaft coupling

REFINERS! PIPE LINE MEN! DRILLING ENGINEERS! LABORATORY TECHNICIANS!

Thomas Couplings are used to advantage on Pumps, Compressors, Cooling Towers, Rigs or any other tough job where continuous operation and dependability are required.

Future maintenance costs and shutdowns are eliminated when you install Thomas Flexible Couplings.

UNDER LOAD and MISALIGNMENT ONLY THOMAS FLEXIBLE COUPLINGS OFFER ALL THESE ADVANTAGES.

1 Freedom from Backlash Torsional Rigidity
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3 Smooth Continuous Drive with Constant Rotational Velocity
4 Visual Inspection While in Operation
5 Original Balance for Life
6 No Lubrication
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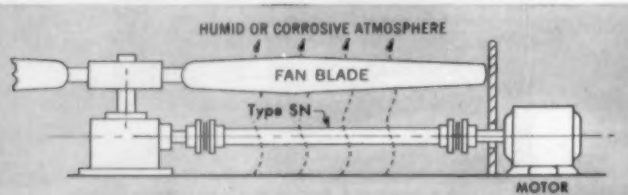



COOLING TOWER INSTALLATION

In the typical cooling tower installation shown above, the motor — outside the humid or corrosive atmosphere — is connected by a floating-shaft coupling to the gear box under the large slow-speed, horizontal-blade fan.

Write for engineering catalog 51A, and the name of your nearest Thomas representative

THOMAS FLEXIBLE COUPLING COMPANY

WARREN, PENNSYLVANIA, U.S.A.


## Three new stainless-steel valves

. . . for service in handling corrosives are detailed in a new section added to the 1959 edition of Rovalve Catalog 425. Valves illustrated in the section are a general purpose and a wedge-gate, both capable of handling all liquids and sludges carried in pipelines.

The third valve has a driptight shutoff, achieved through a replaceable resiliant seat, and may be used as either a stock or wedge gate. **Contact Manufacturer: W. G. Rovang & Associates, Inc., 1945 North Columbia Boulevard, Portland, Ore., for Rovalve Catalog 425.**

## Steel-alloy studs, carbon hex nuts

. . . are described in a new available four-page publication. It outlines advantages of alloy studs and threaded bars. Bulletin 1019-R lists complete physical properties together with information on standard, special, and stainless-steel grades. Recommendations for various service conditions are included. **Contact Manufacturer: Republic Steel Corp., Advertising Div., 1441 Republic Building, Cleveland 1, for Bulletin 1019-R.**

## Tubing of carbon and alloy steels

. . . is detailed in new 70-page Technical Handbook A-2 now available. It covers definitions, specifications, sizes, tolerances, sampling, testing, packing, marking, machining, heat treating, properties, and mill products. Information is presented with charts, tables, and drawings. **Contact Manufacturer: Ohio Seamless Tube Div., Copperweld Steel Co., Shelby, Ohio, for Technical Handbook A-2.**

## Single-basket strainers

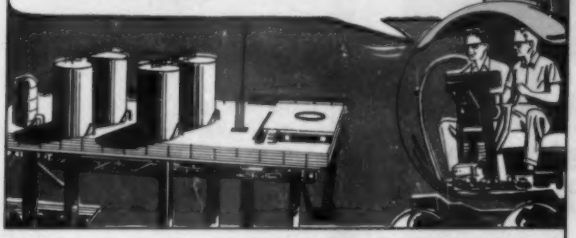
. . . for medium and fine straining of liquids at pressures to 125 psig. are described in new Bulletin 9S-A. The literature presents complete dimensional, size, capacity, and pressure-drop data, plus viscosity correction factors.

Sectional drawings illustrate the simplicity of design and quick-opening features. **Contact Manufacturer: Schutte & Koerting Co., Dept. HT-I, Cornwells Heights, Buck County, Pa., for Bulletin 9S-A.**

1.

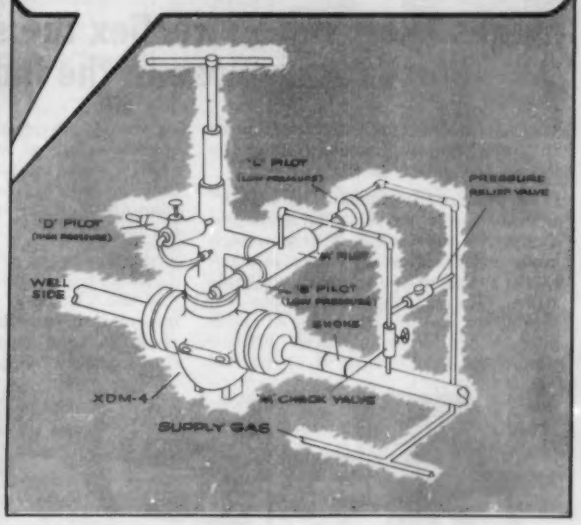
# OTIS SURFACE SAFETY VALVES

— EQUIPPED WITH AUTOMATIC PILOTS — SHUT IN THE SIX WELLS ON THIS PLATFORM AND **PREVENTED A MAJOR FIRE** THAT COULD HAVE COST US SEVERAL MILLION DOLLARS.



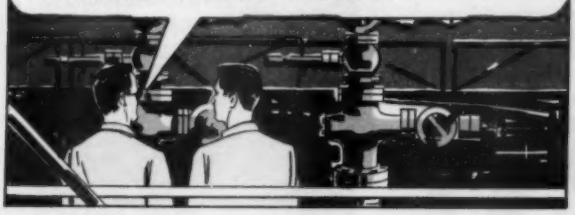
2.

HERE'S A DIAGRAM OF THE SAFETY VALVE AND AUTOMATIC PILOT INSTALLATION WE HAD ON THIS PLATFORM. EACH OF THE SIX WELLS HAD A TYPE XDM-4 OTIS SURFACE SAFETY VALVE INSTALLED BETWEEN THE WING VALVE AND THE CHOKE. THE SAFETY VALVES AND PILOTS WERE INSTALLED SO AS TO (1) SHUT IN AN INDIVIDUAL WELL SHOULD A FREEZING CONDITION EXIST IN A FLOW LINE OR CHOKE; (2) SHUT IN ALL WELLS ON THE PLATFORM SHOULD A FLOW LINE BREAK, OR (3) SHUT IN ALL WELLS ON THE PLATFORM SHOULD THE GAS SALES LINE BREAK, OR SHOULD SOMETHING HAPPEN TO ANY OF THE AUXILIARY EQUIPMENT ON THE PLATFORM. IN THIS CASE IT WAS HIGH TEMPERATURE ON A HEATER THAT ACTIVATED A TYPE L OTIS PILOT TO SHUT IN ALL THE WELLS.



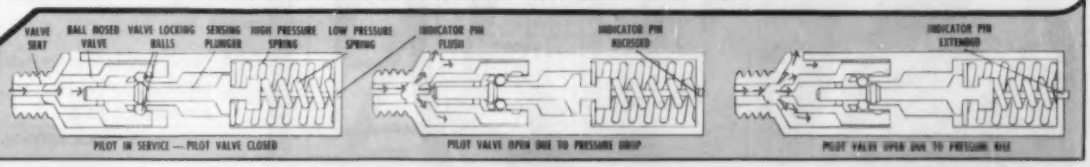

3.

THE SIX WELLS WERE PRODUCING 32 M.M.C.F.D. WHEN AN EQUIPMENT FAILURE BOOSTED THE TEMPERATURE IN ONE OF THE HEATERS TO ABOUT 1,000° F. THIS SET THE PLATFORM ON FIRE. BUT WE DIDN'T LOSE OUR WELLS OR THE PLATFORM — THANKS TO THE OTIS SAFETY VALVES. WHEN OUR PUMPER GOT OUT THERE HE FOUND ALL OF THE WELLS SHUT IN, AND ONLY A SMALL FIRE BURNING, WHICH HE EXTINGUISHED. AFTER MAKING LIMITED REPAIRS, THE SAFETY VALVES AND PILOTS WERE RESET AND THE WELLS PUT BACK ON PRODUCTION.



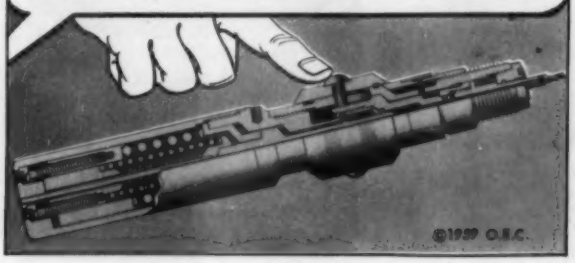
4.

SPEAKING OF RESETTING PILOTS, HAVE YOU SEEN THE NEW TYPE E OTIS HI-LO PILOT? IT'S SO SIMPLE TO SET AND RESET A TEN-YEAR-OLD BOY COULD DO IT. HERE ARE THREE SCHEMATIC DIAGRAMS OF THE TYPE E, SHOWING THE PILOT IN ITS THREE OPERATING POSITIONS: SET AND READY TO OPERATE; OPENED AS A RESULT OF A PRESSURE DROP; OPENED AS A RESULT OF A PRESSURE RISE. THE NEW TYPE E PILOT HAS MANY FEATURES WE LIKE. TO LIST A FEW — IT'S QUIET. THERE'S NO LOUD POP WHEN IT OPENS. THEIR STANDARD MODEL IS RATED TO 8,000 P.S.I. AND WE CAN GET HIGHER PRESSURE RATINGS ON SPECIAL ORDER. THE TYPE E IS ADAPTABLE TO REMOTE CONTROL OR EXTERNAL CONTROL SYSTEMS USING ELECTRICITY, HYDRAULIC PRESSURE, OR MICROWAVE. YOU CAN TRIP THE PILOT MANUALLY WITHOUT ANY SPECIAL TOOLS. WE'VE FOUND THE PILOT ACCURATE TO PLUS OR MINUS 1%. IT HAS A VISUAL INDICATOR TO TELL YOU WHEN THE PILOT IS LOCKED OUT OF SERVICE, AND ANOTHER INDICATOR TO TELL YOU WHETHER THE PILOT OPERATED DUE TO A PRESSURE RISE OR DROP.




5.

TO GET BACK TO RESETTING THE TYPE E OTIS HI-LO PILOT — HERE'S ALL YOU DO. AFTER THE PILOT HAS OPERATED YOU TWIST THIS RESET COLLAR TO THE RIGHT. THIS CLOSES THE PILOT AND EXPOSES A RED BAND, WHICH IS A VISUAL INDICATION THAT THE PILOT IS LOCKED OUT OF SERVICE. WHEN THE INDICATOR PIN IS FLUSH WITH THE END OF THE PILOT YOU CAN PUT THE WELL BACK ON PRODUCTION BY TWISTING THE RESET COLLAR TO THE LEFT. WE'LL BE USING A LOT OF THESE PILOTS IN THE FUTURE BECAUSE OF THEIR SIMPLICITY AND MANY ADVANTAGES.




6.

THE OTIS SURFACE SAFETY VALVES AND PILOTS WE INSTALLED ON OUR PLATFORM ONLY COST $6,500. THAT'S A PRETTY SMALL INVESTMENT TO PROTECT A SEVERAL-MILLION-DOLLAR INSTALLATION. AND THIS ISN'T THE FIRST TIME OTIS SAFETY EQUIPMENT HAS SAVED US A SUBSTANTIAL LOSS. EXPERIENCE HAS TAUGHT US WE CAN RELY ON OTIS SAFETY EQUIPMENT. IF YOU HAVE **ANY UNPROTECTED WELLS** — ESPECIALLY IN ISOLATED LOCATIONS OR IN CRITICAL AREAS — I SUGGEST YOU CALL YOUR NEAREST OTIS OFFICE NOW. LET AN OTIS SAFETY VALVE EXPERT HELP YOU WORK UP THE PROPER SAFETY PROGRAM FOR YOUR WELLS—**TODAY—BEFORE YOU NEED IT.**

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Thermoid Powerflex Hose not only can operate safely at any pump pressure now available, but has a reserve strength that insures against blow-outs, thus guaranteeing uninterrupted service during its long life.

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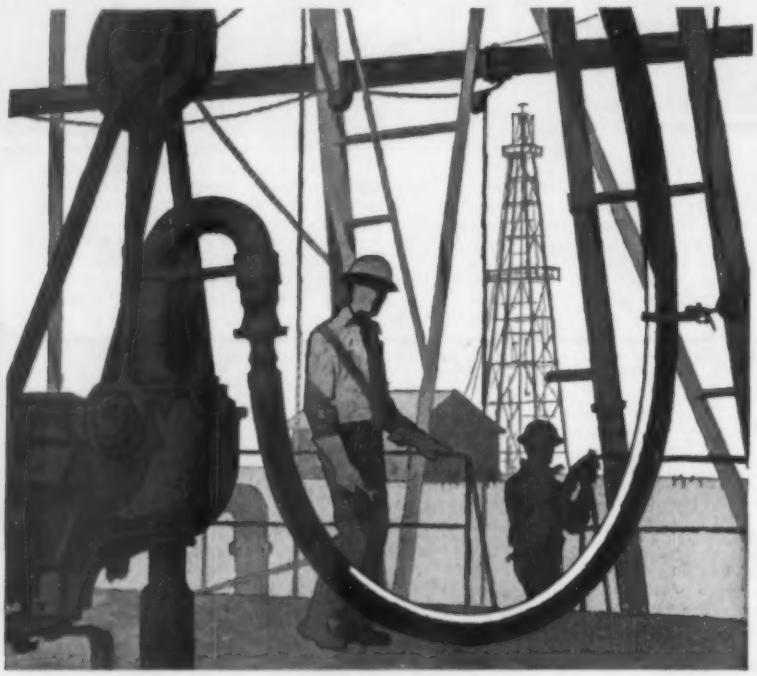

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### James W. Torrant takes over

. . . as industrial sales manager of Morse Chain Co., a Borg-Warner industry in Ithaca, N. Y., announces John V. Moynes, vice president and general sales manager.

Torrant was with Dayton Rubber Co. for 20 years, and held the post of general sales manager of the Industrial Division until his recent appointment.

### Oil Well Supply appoints three

R. E. Dickson

R. E. Dickson has been named assistant to the vice president, sales; J. P. O'Toole, to eastern area manager at Columbus, Ohio; and William G. Smith, eastern area district manager at Olney, Ill., for U. S. Steel Corp.'s Oil Well Supply Division.

Dickson was employed by Oilwell in 1938 at the Dallas accounting department. Three years later he was transferred to the U. S. Steel audit department, but returned to the Dallas office in 1944 as general accounting supervisor.

Dickson was appointed assistant to the vice president, merchandise in 1950, and in 1957 was transferred to the sales department and appointed district manager of the Canadian area at Edmonton, Alta.

O'Toole, who started with the division in 1935, most recently was district manager at Evansville, Ind.

Smith began with Oilwell 13 years ago at Carmi, Ill. In 1948 he was named store manager at Carmi, and in 1955 was transferred to Olney and made assistant district manager.

### Dick W. Johnson is promoted

. . . by Harley Sales Co., to general sales manager. Johnson was a water-flood engineer with Atlantic Refining Co. for several years before joining Harley in 1952.

### Western Co. will relocate

. . . its general office facilities in Fort Worth about the end of June, reports H. E. Chiles, president of the oil-well servicing concern now headquartered in Midland, Tex.

The company will conduct its accounting, research, and general-planning functions from the new location. Supervision of sales and field services will remain in the division offices headed by Charles Simmons at Midland and C. E. Wooldridge at Oklahoma City.

In addition to Chiles, personnel included in the move are Walter Beadle, vice president of operations-sales; Roscoe C. Clark, manager of research; J. S. Brown, controller, and their immediate staffs.

### Stewart, Hobbs assume duties

. . . as district manager and district sales manager, respectively, in the New Orleans district of Dowell Division of The Dow Chemical Co.

J. B. Stewart

J. P. Hobbs

Joseph B. Stewart will move from Dowell's general office in Tulsa, where he had been manager of the technical service and development operations since January. Stewart joined the company 3 years ago.

James P. Hobbs, who started with Dowell in 1949, leaves a special assignment in Odessa, Tex. to take his new position. Before this assignment, Hobbs was with United Oilwell Service, S. A., Dowell's subsidiary in Venezuela.

### Dresser appoints new director

J. R. Brown, Jr.

. . . of manufacturing — James R. Brown, Jr.—according to J. B. O'Connor, president of Dresser Industries, Inc. Brown comes to Dresser from Baldwin-Lima Hamilton Corp. in Eddystone, Pa., where he has worked since 1941.

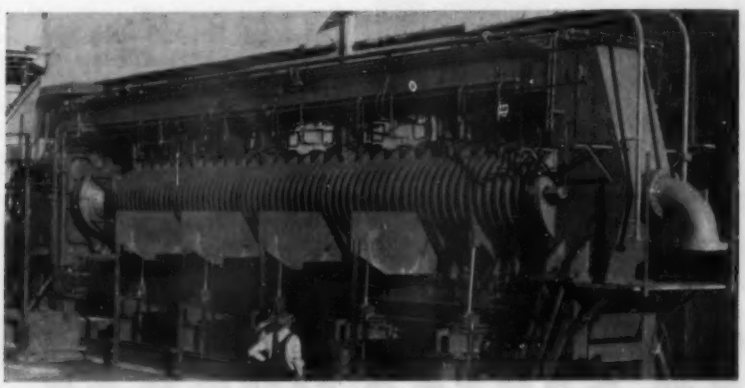
At his new post, Brown will be a member of the Dallas headquarters staff. He will be responsible for evaluating manufacturing processes and procedures, analyzing the capital expenditures program, and making recommendations in general business areas having to do with manufacturing among the Dresser companies.

Brown will report to John Lawrence, executive vice president.

### SEPCO plans new branch office

. . . in Corpus Christi, Tex., and announces two personnel changes within the company. The building will house the local sales office of Southern Engine & Pump Co., as well as a parts department, warehouse, and service department.

J. E. Kelly, formerly of SEPCO's



**HYDRAULIC PIPE EXPANDER** similar to the unit shown, will be manufactured by Kaiser Steel Corp.'s Napa, Calif. fabricating division plant for Japan's first large-diameter pipe mill. The Napa plant has been awarded a $2½ million contract to manufacture pipe-producing equipment for a mill to be installed at Japan Steel & Tube Co.'s integrated mill near Tokyo.

# "Over 630,000 feet of hole drilled with the same U. S. Royal 4 Rotary Hose"

*says "Red" Royal*

"This is one of the best stories I've come across so far", continues "Red" Royal. "Jim Wilkerson (toolpusher) and Joe McRee (driller) of Falcon-seaboard Drilling Company say this U. S. Royal 4 Rotary Hose has been on the job *more than seven years*... and in that time has drilled 630,000 feet in Texas, Oklahoma, Colorado, Nebraska."

Adds Wilkerson, "It has performed way above average and, as you can see, is still on the job. What's more we also get top service from U. S. Mud Pump Vibrator and U. S. Mud Pump Suction Hose."

"Red" Royal knows many a cost-conscious contractor who relies on U. S. Royal 4 Rotary Hose to save every possible drilling dollar. In field after field, this hose piles up the best performance records. U. S. Royal 4 is the hose that handles the highest pressures on today's pumps—it's used all the way from spud to pay.

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Dallas office, has been transferred to Corpus Christi and is now manager of that branch. N. M. Shuyler of Houston is now in Corpus Christi and in charge of the service department.

**Troy C. Stedman is appointed** ... West Coast regional sales and service manager of Cameron Iron Works, Inc.'s Oil Tools Division. Stedman has been with Cameron since 1951. From 1952 through 1958 he was engaged in sales and service at McAllen, Tex.

**Clark Bros. Co. announces** ... three new sales appointments. Ernest G. Hotze has been named southwest district manager, according to George W. Probst, Clark vice president in charge of sales.

E. G. Hotze

Hotze has been with the organization since 1942, serving as technical service engineer, sales engineer, assistant district sales manager, and Houston district manager.

J. Y. Allen, Jr.

J. R. Hutton

Joe Y. Allen, Jr., former assistant district manager, succeeds Hotze as district manager at Houston. Allen will be in charge of the Houston and Corpus Christi offices.

Named as district manager under Hotze is James R. Hutton, who will head the newly created Louisiana-Mississippi district. Hutton was formerly Shreveport branch manager.

**John L. Ross is appointed** ... a petroleum engineer in The Fort Worth National Bank's oil-loan division. He formerly was a division reservoir engineer with Gulf Oil Corp.

Ross joined Gulf as a student engineer in Centralia, Ill., 11 years ago. He held various engineering assignments with the company in Oklahoma and New Mexico before his transfer to Fort Worth in 1951.

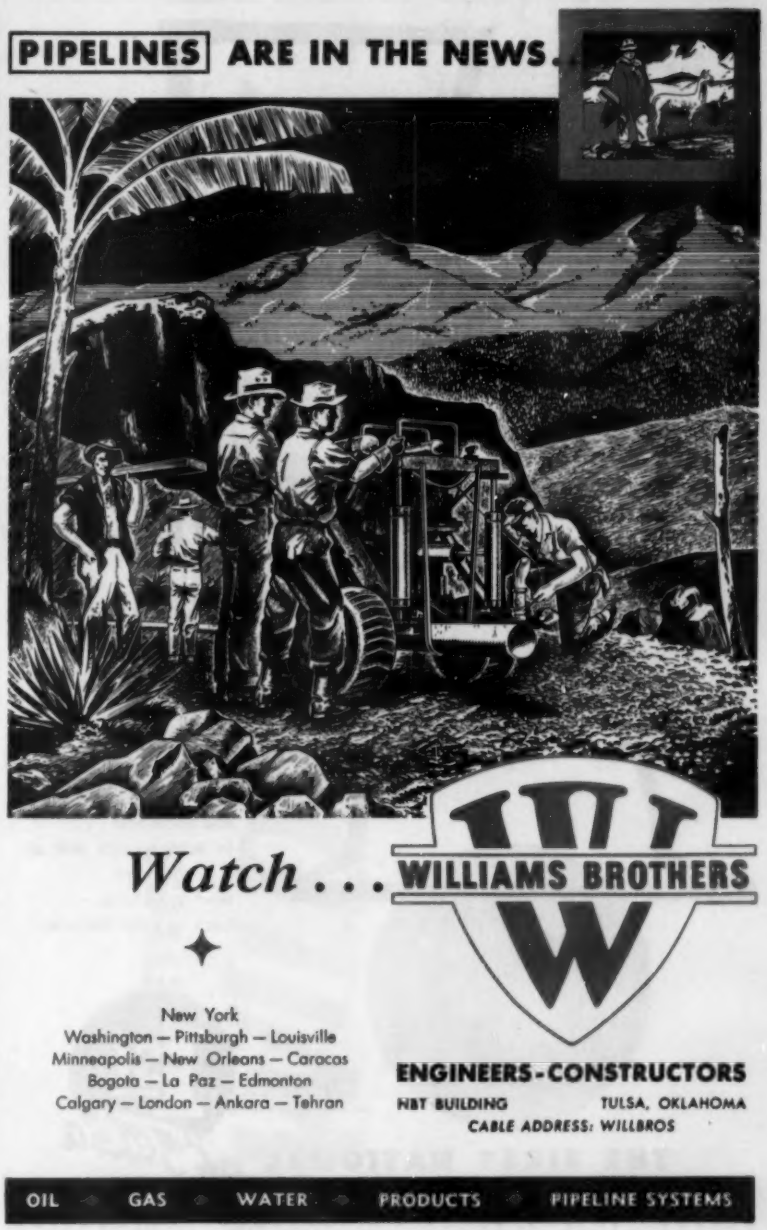
**Gilbert T. Bowman is elected** ... a vice president of Rockwell Mfg. Co. He will be in charge of the firm's International Division and Petroleum & Industrial Division.

Bowman joined Rockwell in 1940 as a sales engineer in northern California, became San Francisco district sales manager 5 years later, sales manager of gas products and Nordstrom valves in 1952, and general products manager in 1954. He was promoted to vice president of the company's Meter & Valve Division in 1956.

Before joining Rockwell, Bowman was employed by Michigan Consolidated Gas Co.

**C. E. Sutton is named manager** ... of marketing in General Electric Co.'s gas-turbine department at Schenectady, N. Y., announces G. W. Elston, department general manager.

Sutton, who has served as manager of marketing in the company's apparatus service-shops department, suc-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ceeds Edward G. Naylor, who was named manager of plant sub-contracting operations.

### Ben Sloat to represent

. . . oil-field sales in the southwest for Hagan Chemicals & Controls, Inc. and its divisions Calgon Co. and Bradford Laboratories. Sloat will locate in Tulsa.

Formerly a staff engineer with Hagan's administrative and research center in Pittsburgh, Sloat has done extensive work in oilfield water problems, with particular emphasis on problems related to secondary-recovery water-flood projects.

### Ray R. Sloan named manager

. . . of the newly formed Engine Sales Division of Albert & Harlow, Inc., Caterpillar dealer in Tulsa serving eastern Oklahoma. Backed by 30 years experience, Sloan has been an engine field representative for Caterpillar Tractor Co. in the United States, Canada, and Mexico.

Albert & Harlow sells and services a complete line of Caterpillar diesel engines, ranging from 68 to 700 hp. in industrial, electric set, and marine versions.

### Wisconsin Motor officials greet

. . . the 3,000,000th engine to come off the corporation's production line. The event added spark to the Milwaukee company's 50th anniversary of engine progress, being observed this year.

### Genesys names D. E. Dufford

. . . head of applications engineering. The new engineering group will provide service for the recently announced joint developmental and investigative venture with Sun Oil Co. Dufford has worked in computation and control with Autonetics, Marquardt Aircraft, and Telecomputing Corp.

Genesys Corp. is a Los Angeles subsidiary of Chance Vought Aircraft, Inc.

### Wiley Noble & Associates formed

. . . in Houston to specialize in mechanical and patent engineering. The new firm will place heavy emphasis on downhole equipment used by the drilling industry. Also, Noble will specialize in patent investigation work and act as an expert in patent litigation.

Noble recently resigned from Reed Roller Bit Co., where he was vice president and a director. He joined Reed in 1935.

### Robert L. White is appointed

. . . advertising manager, in which position he will supervise Walworth's sales promotion, product and financial publicity, trade-paper advertising, direct mailings, trade shows, and product literature. White has been with the advertising department 8 years.

### J. R. Sabina is named manager

. . . of the tetraethyl lead and planning section of du Pont Co.'s Petroleum Chemical's Division. He succeeds T. Baldwin Prickett who retired after a 33-year career in the petroleum industry.

Sabina joined du Pont in 1937. He designed the company's petroleum laboratory at Deepwater Point, N. J.

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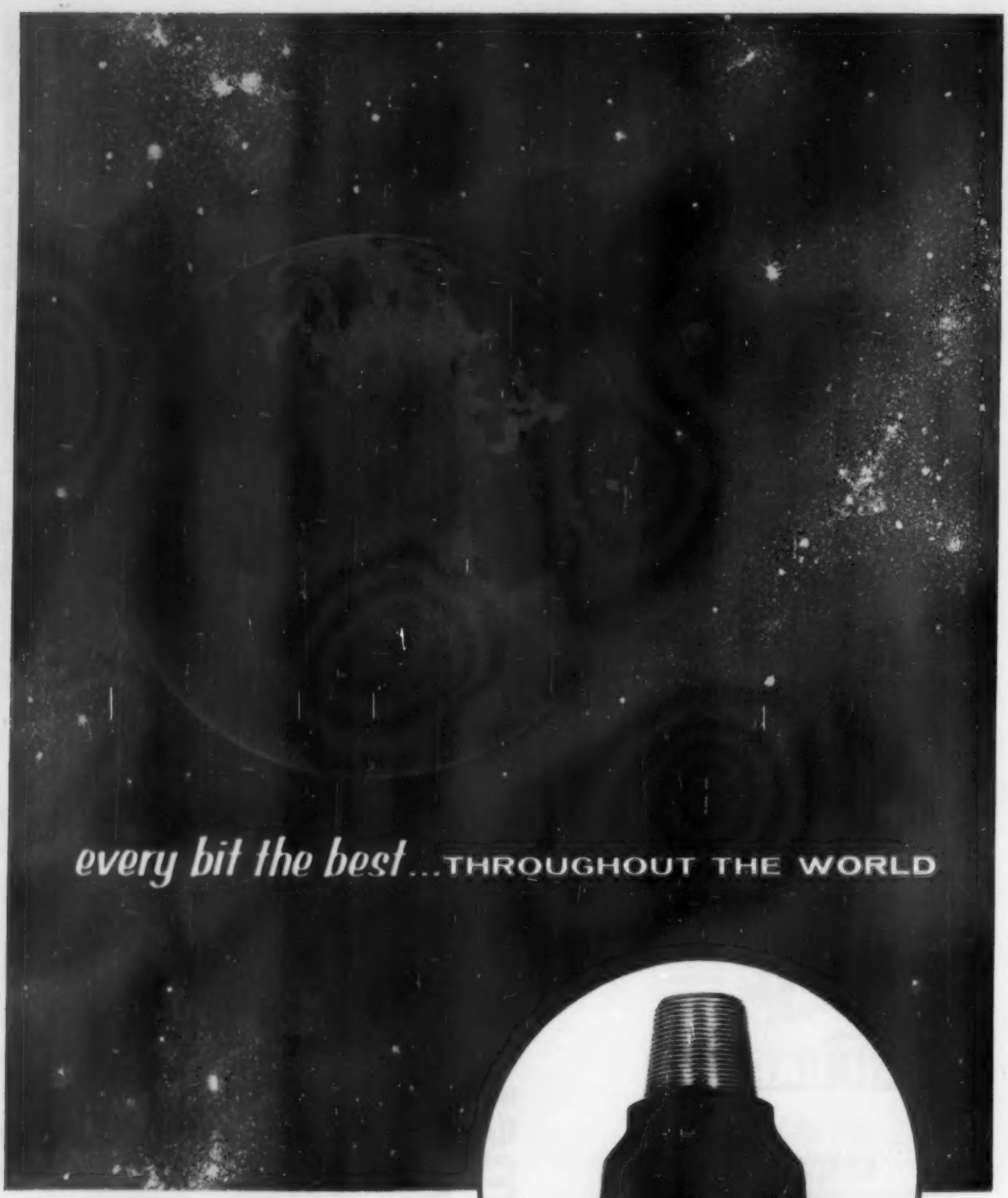


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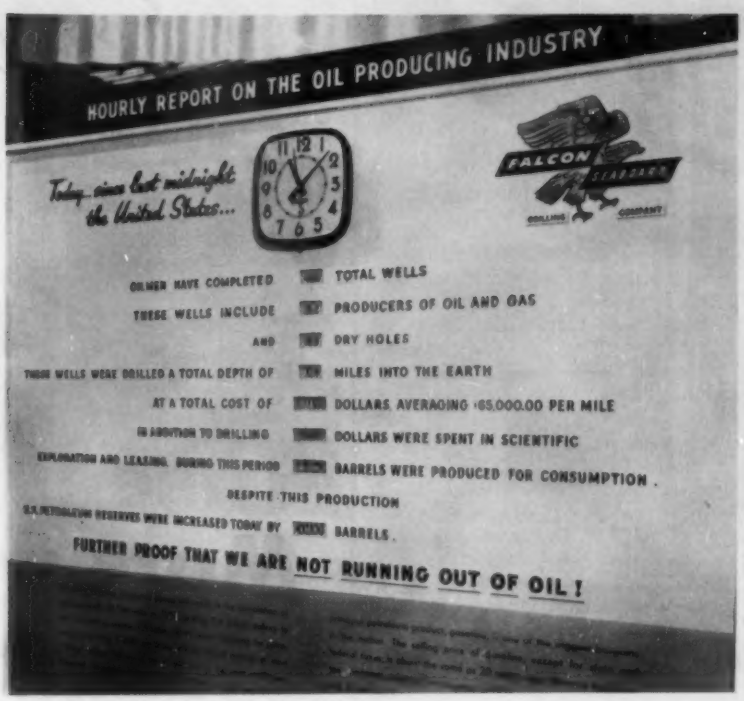
HOURLY REPORT ON THE OIL PRODUCING INDUSTRY
Today, since last midnight the United States...
FALCON SEABOARD DRILLING COMPANY
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TOTAL WELLS
THESE WELLS INCLUDE
PRODUCERS OF OIL AND GAS
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THESE WELLS WERE DRILLED A TOTAL DEPTH OF
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AT A TOTAL COST OF
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DOLLARS WERE SPENT IN SCIENTIFIC
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An IPE holdover, this animated

# Chart tells industry data

A NEW IPAA CHART shows the number of wells drilled daily, total depth, number of dry holes, and other statistics of the oil industry.

The recent presentation to the Independent Petroleum Assn. of America by Falcon Seaboard Drilling Co., Tulsa, is for use by the IPAA at meetings and conventions.

Falcon Seaboard sponsored the electrically operated chart which was displayed at the International Petroleum Exposition in Tulsa. The hour-by-hour chart was the joint idea of Paul Fitzgerald of Dowell Division of Dow Chemical Co. and IPAA public relations staff headed by Lloyd Unsell.

# Large Green River basin program

GREEN RIVER Basin Corp., a subsidiary of Rocky Mountain Corp., Chicago, has taken initial steps toward an extensive exploratory campaign in the Green River basin of Wyoming. Program includes eight units planned in the basin.

Falcon Seaboard Drilling Co., Tulsa, is contractor for the first test scheduled as 1 Gilcrease, SE NE NW 25-39n-11w, in the Hoback Creek area of Teton County. This venture is a farmout from Green River Basin Corp. to H. N. Goodell and Bradco Oil, Houston, the operators. Closest drilling to the 1 Gilcrease was done in 1947 by Sinclair Wyoming Oil at 1 Granite Creek Unit, NE NE 27-39n-114w.

Green River Basin Corp. has received approval from the USGS on the Reardon Draw Unit, Sublette County, where Belfer Natural Gas is drilling below 4,750 ft. at 1 Unit, NW NW 9-28n-110w. On five units pending USGS approval, Green River Basin Corp. will drill five Mesaverde tests ranging in depth from 11,000 to 16,000 ft. These five units are located along a northwest-southeast 55-mile trend. Position of this trend lies between townships 33n-112w and 28n-107w, Sublette County. Total area of the five units is roughly 200,000 acres.

Of the two remaining units also pending approval one is the Adams Creek Unit consisting of 17,500 acres in 37 and 38n-115w, Lincoln and

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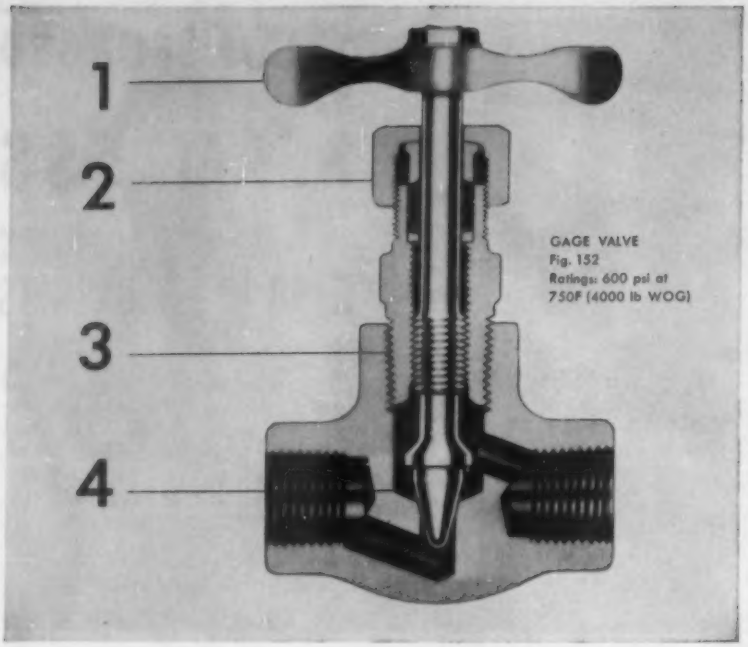


GAGE VALVE
Fig. 152
Ratings: 600 psi at 750F (4000 lb WOG)

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**STRONGER VALVE BODIES:** Edward *gage valves* are made of drop forged steel for sounder structure and greater strength than valve bodies machined from bar stock. Available in carbon steel, 13% chromium stainless steel or 18-8 stainless steel.

Edward instrument valves have a carbon or 13% chromium stainless steel body. Carbon steel body has an integral cobalt-chromium-tungsten alloy steel seat that resists pitting and gives maximum resistance to corrosion and erosion. You have a choice of screwed or socket welding ends.

INSTRUMENT VALVE
Fig. 952
Ratings: 2500 psi at 850F (6000 lb WOG)

**MANY FEATURES:**

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2. **On gage valves, the bonnet and packing nut are EValized (exclusive Edward plating process) to minimize galling and corrosion. Instrument valves have EValized gland and gland bolt nuts, stainless steel gland bolts.**
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4. **Semi-needle, integral stem-disk is made of EValloy 13% chromium or 18-8 alloy stainless steel, hardened for wear resistance on both gage and instrument valves.**

For additional information, see your favorite distributor, or write to Edward Valves, Inc., 1212 West 145th Street, East Chicago, Indiana. Subsidiary of Rockwell Manufacturing Company.

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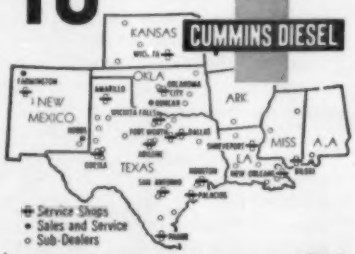


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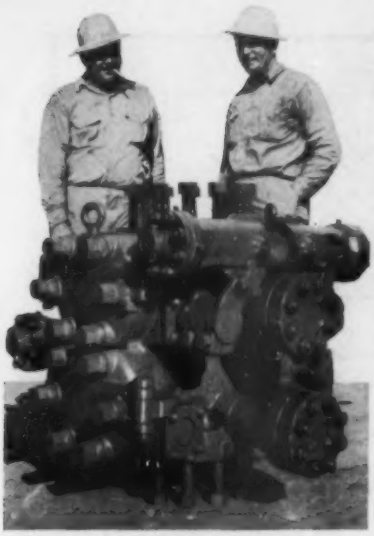

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Teton counties. The eighth and last proposed unit awaiting USGS decision is Leidy Creek Unit, a 5,000-acre block which will be operated by Rocky Mountain Corp. in 44n-113w, Teton County.

## New venture set for Denver basin

Front Range Oil & Uranium Co. moves into Denver basin for its first test. Contractor for the well is TWH Drilling Co. Plans have been made for several exploratory efforts in the basin this year.

Location for the initial venture, a Texaco, Inc., farmout, is in 11-17n-50w, Morrill County, Nebraska. This spot is a mile and one-half west of Ohio Oil Co. Lane pool. Objective is the "J" sand.

Front Range has also scheduled several development wells in Knox County, Texas, where it has been working in the Hackathorn pool since 1957. It recently completed its sixteenth consecutive well of a 20-test commitment there on a Union Oil Co. of California farmout.

## Nocal Afton test

General Exploration Co. has staked location for a northern California 7,000-ft. hole. Brown Drilling was awarded contract for the test located in the Afton area of Glenn County. Named Max Pray-Central Valley-Boyd 1-A Unit, it is located in SW 2-18n-1w, and will drill the "F Zone" on a 4,000-acre spread. General Exploration will be the operator with a 25% working interest. Humble Oil & Refining Co. and Richfield Oil Corp. will contribute approximately two-thirds of the cost of the well in dry-hole money. This operation is 1 mile southeast of the Afton gas field.

## Wyoming paces RM rotaries

For the week ending June 1, Wyoming continues to lead other Rocky Mountain states in the number of active rotary rigs running.

Hughes Tool Co. figures showed an increase of seven over the previous week. The second highest state was Colorado with 44 working units, down 5 rigs from a week ago.

Other areas making gains were Nebraska and Utah. States having less activity with changes noted are: Montana from 19 to 16; North Dakota from 41 to 31, and South Dakota from 3 to 1. There was no action in Idaho drilling.

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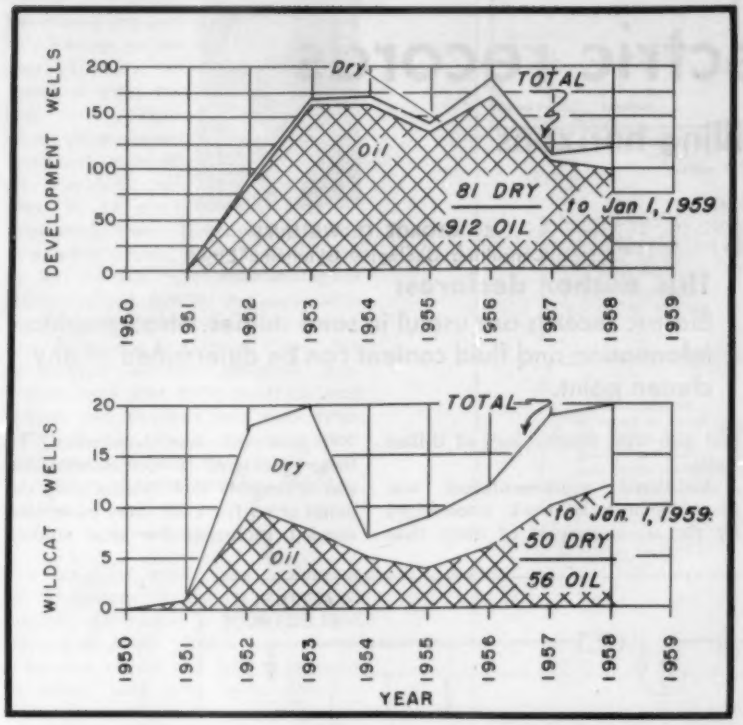



**DRILLING OPERATIONS** on North Dakota's Nesson anticline have set an unusual success record. Wildcats have been 53% hits, while field drilling success reached 91%.

# North Dakota oil finders look at Nesson anticline

BY FRANK J. GARDNER

NORTH DAKOTA has done itself proud in developing its youthful oil and gas industry. Perhaps no other state has nurtured its oil business from infancy to adolescence with as much loving care as has this state.

From the first announcement of the recovery of a pint of oil in the Amerada Petroleum Corp. 1 Iverson in April 1951, drilling and development have gone forward in an orderly fashion under the guidance of a super-efficient state regulatory body. No other state's oil industry is as well documented as is that of the Flickertail State.

Typical of the careful and dedicated coverage which North Dakotans have devoted to their oil industry is a new book just released by the North Dakota Geological Society. It is called "Nesson Anticline of North Dakota." It's an exhaustive study of the oil and gas fields strung out along this huge uplift in the deepest part of the Williston basin.

The Nesson anticline stretches 72 miles in a north-south direction across the western half of North Dakota. It is a moderate to low-relief uplift plunging southward at about 30 ft. per mile; the southernmost producing field on it sits about 2,000 ft. structurally lower than the northernmost one. Several areas of closure lie along its crest, and many south-plunging anticlinal noses with fairly low relief are located on the crest and on the flanks. The largest closed anticline along the trend is the Beaver Lodge structure with a minimum vertical closure of 100 ft. and a closed area of about 14 sq. miles (as contoured on the base of the Last Charles Salt-Mississippian).

Upon examining this new history of North Dakota oil, one cannot help but be impressed with the achievements of the oil and gas industry there. In only 8 years the state has moved from a have-not position to one of major importance as an oil producer. Unofficial reports of a billion barrels of oil underlying this Nesson anticline may seem a little wild-eyed today, but in the introduction to this book the North Dakota Geological Society warns us, "Don't belittle the estimate!"

The true picture of progress is best portrayed in this book through a series of charts and tables. They show the rapid growth in production, distribution, reserves, and success ratios along the anticline. Perhaps the most impressive of these is the one shown here. A wildcat success ratio of 53% and a development-drilling success ratio of better than 91% are enviable records indeed.

The NDGS presents a detailed study of 29 oil pools in its new publication. The production history, a type log for the field, discovery details, reservoir data, and spacing patterns are presented for each field. A convenient correlation chart of the Madison group ties in the Nesson anticline, eastern North Dakota, and southeastern Saskatchewan nomenclature. Later, the society expects to release a revision of its previously published "Stratigraphy of the Williston Basin," in which the Mississippian nomenclature will come in for some revision.

The most impressive feature of the Nesson book is an 8-ft.-long structure map of the entire anticline. It shows every producing well and every dry hole along the trend and is contoured at 25-ft. intervals on the base of the Last Charles Salt-Mississippian. Scale of the map is 1 in. to 4,000 ft. Also presented are two large cross-section sheets illustrating the vertical dimension of production along the anticline. These sections cut across individual fields and should prove most useful in studies concerning future Nesson operations.

North Dakota geologists have produced a work of which they can well be proud and which should find a place in the oil library of any operator or organization interested in the North Dakota oil industry. It is to be hoped they will undertake a similar study of their eastern fields before too long.

Here's what

# Surface electric records

## can tell you about drilling horizons

By GEORGE O. WILLIAMS
Consulting Geologist, Oklahoma City

**This author declares:**

**Electric records are useful in sand studies. Stratigraphic information and fluid content can be determined at any chosen point.**

ONE of the first programs instituted when the Oklahoma Geological Survey was reopened 22 years ago was the use of electrical resistivity methods to search for shallow water resources. The Survey used its own development of the Lee Partitioning method.

Experimental work was undertaken by the author following the basic idea of the Survey's procedure. It was concluded that electrical records obtained at the surface could be correlated as logs between themselves and also with electric logs of drilled wells.

Additional experimentation was done. Commercial work, encouraged by the moral support of more than 100 geologists, was undertaken. To these geologists a correlatable log was a tangible tool. Immediately demand arose from the more economic-minded geologists for sand studies.

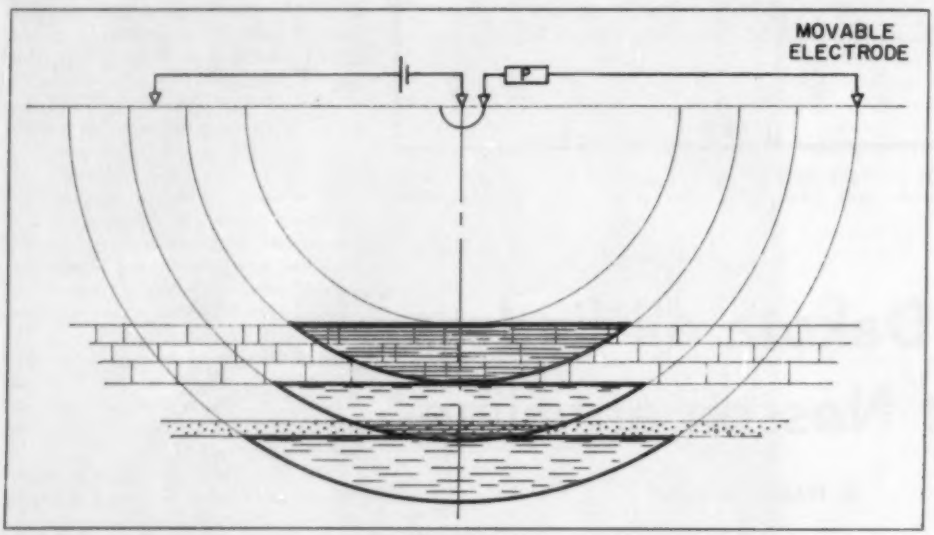
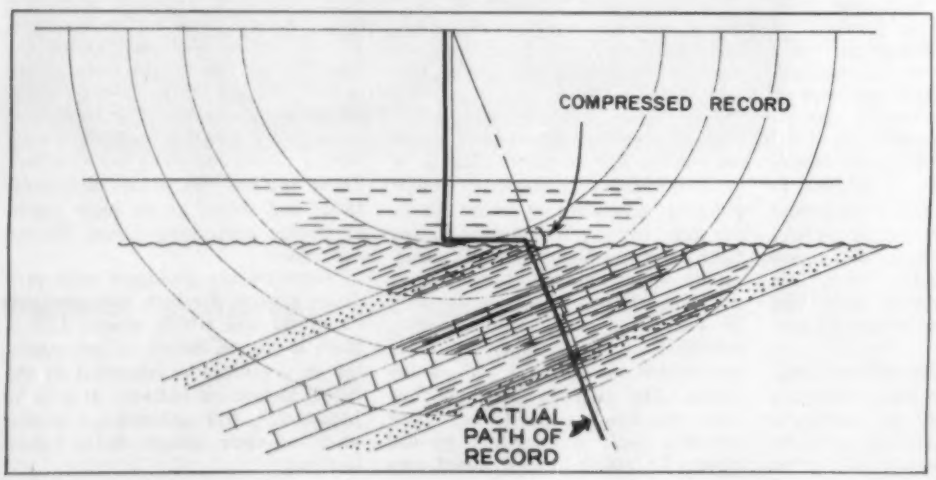



**DIAGRAM** of electrode arrangement showing segments of new section examined by successive positions of movable electrode. Fig. 1.




**ACTUAL** path of record is depicted from horizontal to inclined beds after it crosses an unconfromity. Fig. 2.

## About the author . . .

George O. Williams has played the part of a pioneer for the past 22 years. He seems to enjoy the role, having done much experimentation and research on electrical records. Williams graduated from Syracuse University with a B.S. degree in 1917. Since then he has worked in various geological capacities with East Butte Copper Mining Co., Marland Oil Co. of Colorado, and Producers & Refiners Corp. His background includes electrical geophysics with East Butte in 1922, and seismic and magnetic field work since 1929. He has been a consulting geologist and geophysicist since 1930 and in 1937 he formed Williams Electrical Surveys.

---

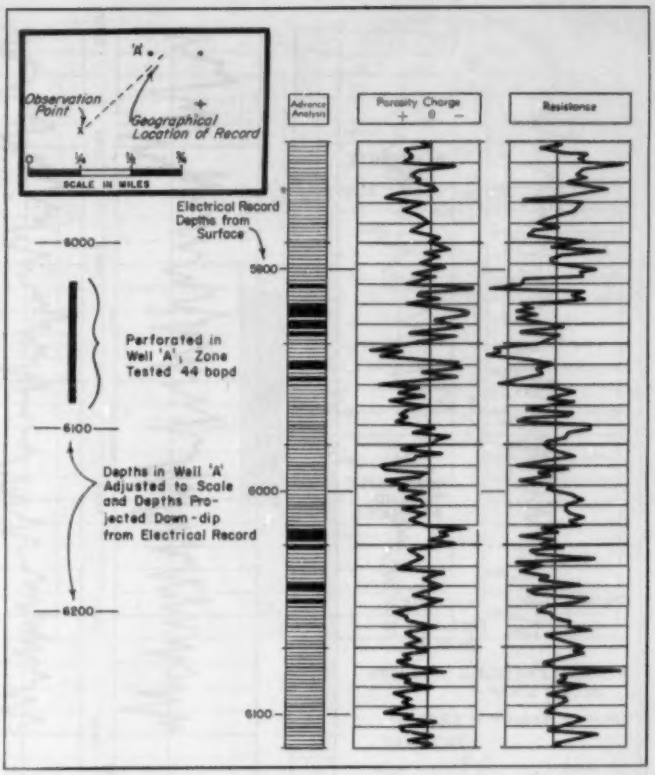
An intriguing aspect was evaluation of formations regarding their fluid content. Ultimately a technique was developed which yielded log patterns indicative of oil and gas saturations in sands, and later these patterns were extended to the interpretation of the fluid content of limestone porosity.

### The Approach

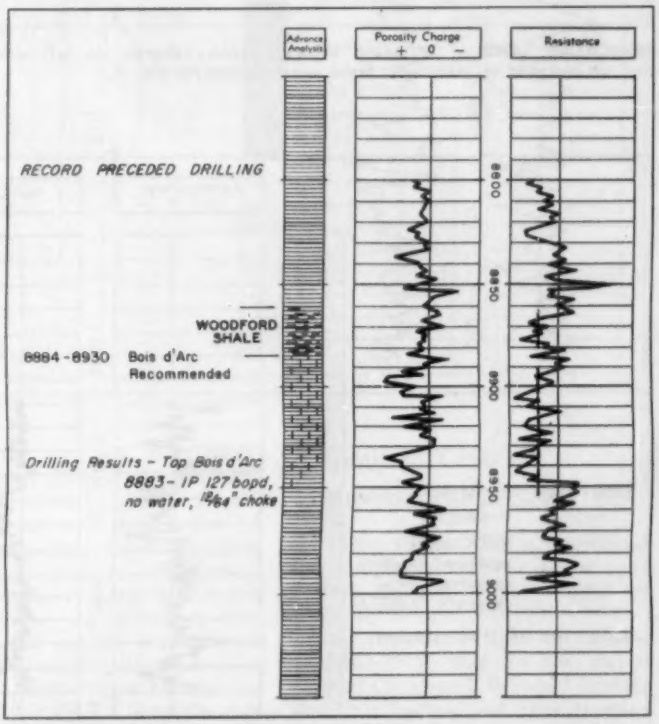
The equipment has an electrode arrangement (Fig. 1) with a movable electrode. The area of new material explored with successive steps ranges outward from the observation station. In field practice, these exploratory points—a, b, c, etc.—are set 2 ft. apart to yield the greatest amount of usable data.

After extensive experimentation, a very low power input of pulsating direct current was selected. The results—identification of formation tops and fluid content of individual horizons—were gratifying. Early field findings were indefensible by all principles of physics generally accepted at that time. Recent development of transistors and studies of the electrical events in their interior have supported the depth representations found by this method of recording effects of stacked-parallel sedimentary beds.

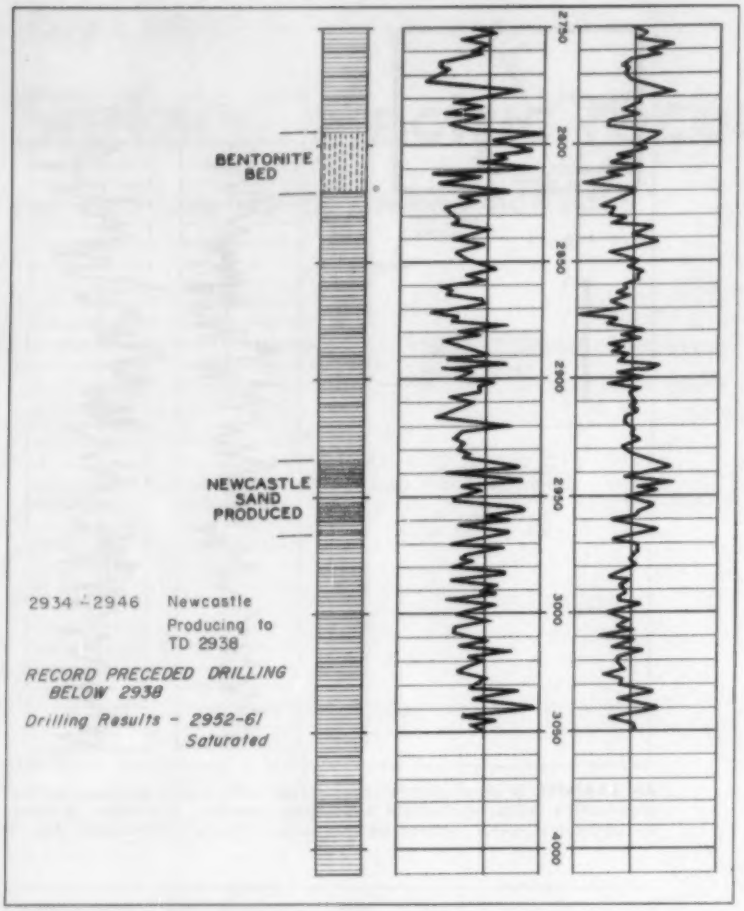
From the earliest days in the development of this technique, theory demanded that the record graph should follow a path at a right angle to the bedding planes. Accumulated experience substantiated this theory, and showed the necessity of adjusting the geographical position of the surface observation point when mapping areas of steeply-dipping beds.



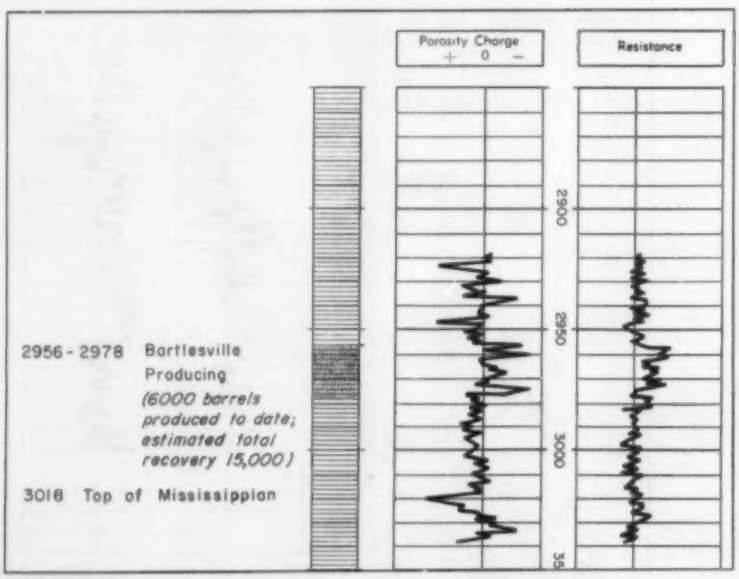

**AN EXAMPLE** of displacement over a half mile found between surface observation point and actual subsurface position. Correction is made by using triangular surface pattern and is easily determined. Fig. 3.




**RECORD** made before well was drilled points up a low resistivity block in the Bois d'Arc lime. Characteristics indicate porous zone. Fig. 4.




**NEWCASTLE SAND** in Wyoming shows negative charge on left side of log and an increase in resistivity. Sand was productive. Fig. 5.




**BARTLESVILLE SAND** in this Kansas record shows both negative charge and higher resistance than average. Fig. 6.

The postulated path of a record through an unconformity from horizontal to inclined beds is shown in Fig. 2. Using a triangular pattern of surface observation stations, and correlating marker-horizons in the record, simple trigonometry establishes the exact geographic position and depth of the record. On the north flank of the Marietta basin in Oklahoma, for example, a displacement of more than a half mile was found between the surface location of the observation station and the subsurface position of the record (Fig. 3).

### Major Factors

Imperative in obtaining a dependable log at the surface are two major items—exact measurement of distances between electrodes, and elimination of leakage in the electrical circuits. Innumerable mechanical details have been solved by trial and error:

- Methods of checking for electrical leakage and of verifying distance measurements.
- Methods of stringing wire.
- Selection of the most suitable sizes and insulations of wires.
- Fast communication between the instrument panel and the movable electrode.
- Choking out highline interference.
- Canceling or eliminating currents due to chemical reaction between electrodes and mineralized ground waters.

Early office problems were numerous and varied. They included correlations between records and interpretation of lithology, porosity, and fluid content.

### Coordination Essential

Coordination of field data with all existing geological and geophysical data is essential. Only then can these records become a successful tool for operators and their geologists in the solution of problems.

A pertinent criticism of these records has been the complete inability of the technique to present a markedly obvious change in passing from a soft shale to a hard lime—an ideal marker in sample logs. Comparison and correlation with records at known wells is imperative for interpretation. A thick body of water-bearing sand will usually show distinguishing features only in the very top. A 200-ft. lower Cypress sand in the Wabash basin of Illinois showed characteristic sand features for only the top 15 ft. Persistent correlation markers are found at 50 to 100-ft. intervals, but are not necessarily at the lithologic markers recognized in sample logs.

**PENNSYLVANIAN** sands in southern Oklahoma have negative charge of oil saturation on left graph of electrical record, but no distinctive resistivity changes at the producing levels. Fig. 7.

The only fixed rule established in the analysis and interpretation of these records is that a negative charge, relative to the shale datum, is associated with fluid hydrocarbons. A zone of positive charge is invariably associated with water as the filling of porosities in a formation.

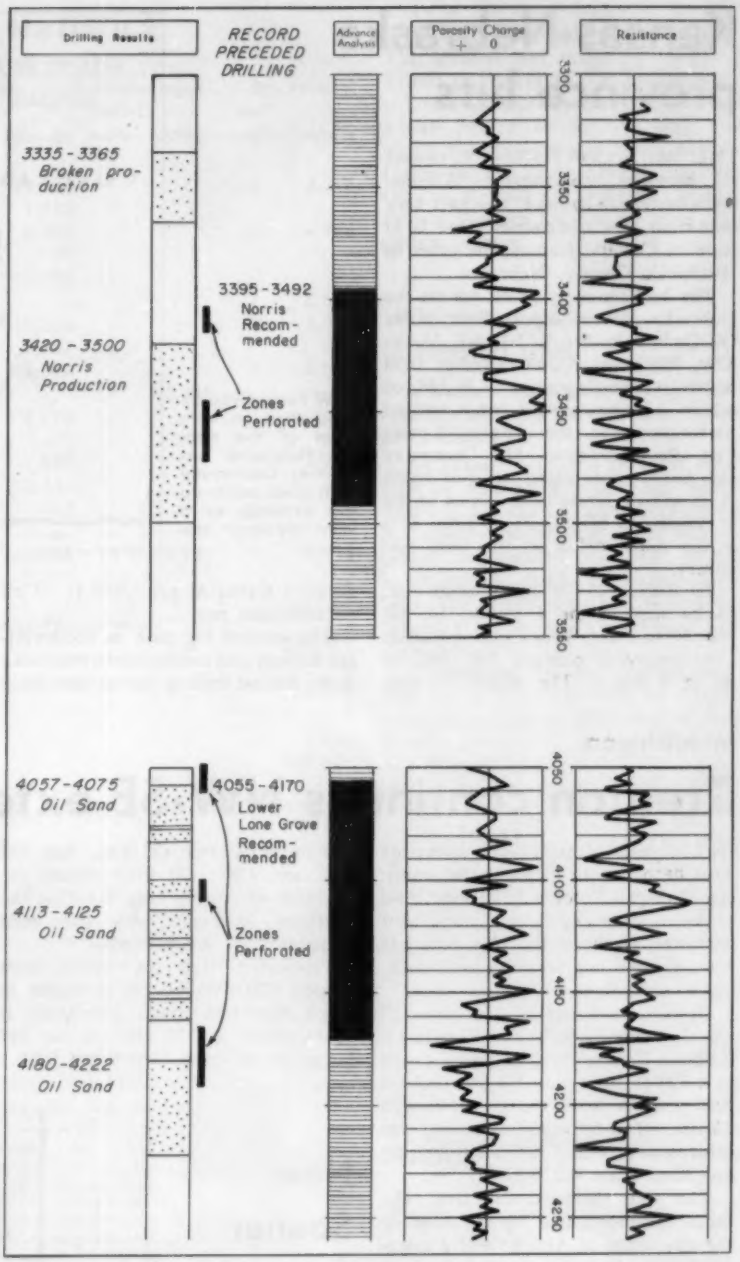
A block of low resistivity is associated with limestone porosity (Fig. 4). This characteristic seems to hold for fracture porosity from Mississippian of Indiana, Ordovician of southern Kentucky, to the Devonian and Ordovician of Oklahoma. When accompanied by negative polarity, this zone corresponds to production.

### Examples

Cretaceous of Wyoming (Fig. 5) and Pennsylvanian-Cherokee of Kansas (Fig. 6) both at producing wells, show the usual negative charge in the producing member, but accompanied by a very definite increase in true resistivity.

Pennsylvanian sands of southern Oklahoma (Fig. 7) show the negative charge of oil saturation on the left graph, with no distinctive change in the resistivity on the right-hand graph in penetrating the sands found productive.

The significance of the last three examples is that a type record must be made of each potential producing horizon in each area studied in order to make a dependable prediction of the fluid content at advance stations. So far it has been impossible to distinguish active producible zones from depleted horizons with a residual oil or gas content, nor has it been possible to estimate the percentage of porosity and permeability in a sand or lime.




# Drilling bids given in West Virginia

WEST VIRGINIA'S Conservation Commission released and accepted sealed bids on the Cooper's Rock State Forest lands. Lease consisted of 13,479 acres, situated in Monongalia and Preston counties, Morgantown and Bruceton Quadrangle, Chestnut Ridge anticline, West Virginia.

Lease stipulated the lessee would pay $1 per acre per year, plus a percentage or fraction of the mineral, to be determined by accepting sealed bids. The bids were opened May 26, 1959, at the State Capitol Building.

Lease was awarded to Orville Eberly and William Snee of Uniontown, Pa. Their bid was as follows: 50% of all oil and gasoline produced and 33.34% of natural gas, at prevailing wholesale prices. Hope Natural Gas Co. and Shell Oil Co. were the only other companies who participated in the bidding.

## Stepout to Ohio's Coshocton completed

In Ohio Clinton Oil Co. announced the completion of its 1 Lewis Lee, Section 8, near New Guilford in Perry Township, Coshocton County.

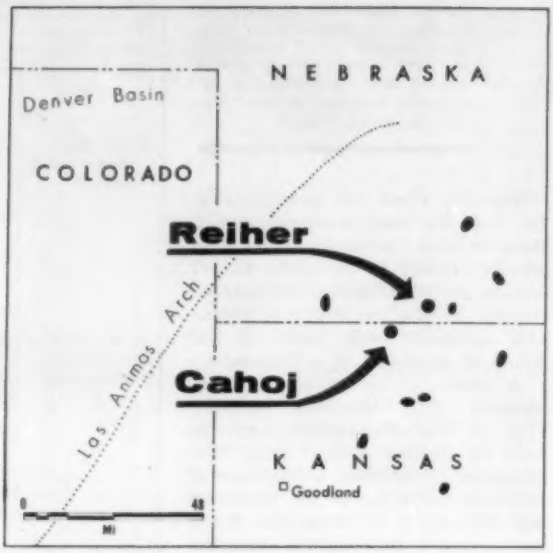
This stepout east had the Clinton at 3,244-75 ft. with 10 bbl. and a show of gas natural. Reported production in a 24-hour test after fracture was 150 bbl. and an estimated 100 M.c.f.

# Kansas-Nebraska province hits

THE MID-CONTINENT'S newest oil province, northwestern Kansas-southwestern Nebraska, has two very important new discoveries. One is in Rawlins County, Kansas; the other in Hitchcock County, Nebraska.

The best recovery of oil yet on the Nebraska side is reported at Skelly Oil Co.'s 1 Reiher, C NE NE 28-1n-32w, Hitchcock County Reiher field discovery, which pumped 196 bbl. of oil on 12-hour test of three sets of perforations in the Lansing-Kansas City-Pennsylvanian. The company also has set production string at 3,965 ft. It will perforate in this zone at the 1 Adams, C SE SE 21-1n-32w. This is the north offset to the field discovery.

In Kansas, 14½ miles southwest, Skelly shut in the 1 Cahor, SE SE NE 17-1s-34w. This Lansing-Kansas City discovery pumped 187 bbl. of oil in 9 hours. The offset, ½ mile north, 1 Cahoj-A, got 3,640 ft. of oil on drill-stem test.




**NEW** Pennsylvanian production on both sides of the Kansas-Nebraska Las Animas-Cambridge arch area points up this province as a very important reservoir.

The current big push in northwestern Kansas and southwestern Nebraska is the busiest drilling period here since the rapid-fire development of Llanos field in Sherman County, Kansas, last year. It was at Llanos that the Pennsylvanian spree in this new province got its start.

In Michigan

# Trenton continues NW-SE extension

IN 2½ years of exploration operators have been unable to prove the southern Michigan Trenton field more than 1 mile wide east and west but northwest-southeast the play now has been chained out 16 miles with nothing in sight to stop it.

Newest extension is McClure Oil Co. 1 Behling, SE SE NE 4-3s-4w Calhoun County. Well logged Trenton at 4,000 ft., had gas at 4,068 and on drill-stem at 4,075-4,165 ft. flowed 43 bbl. oil in 50 minutes. Casing was cemented at 4,265 ft., after logging loss zone from 4,270-81 ft.

The well extended the field 1½ miles northwest and to the edge of the city limits at Albion, where town-lot leasing had been active for past 60 days. As the McClure well tested oil, the Albion city council called a special meeting to set up procedures for drilling within the city. McClure, Ed Rovsek, Leonard Ward, Aurora-Ohio and Carter control bulk of acreage in area of new extension.

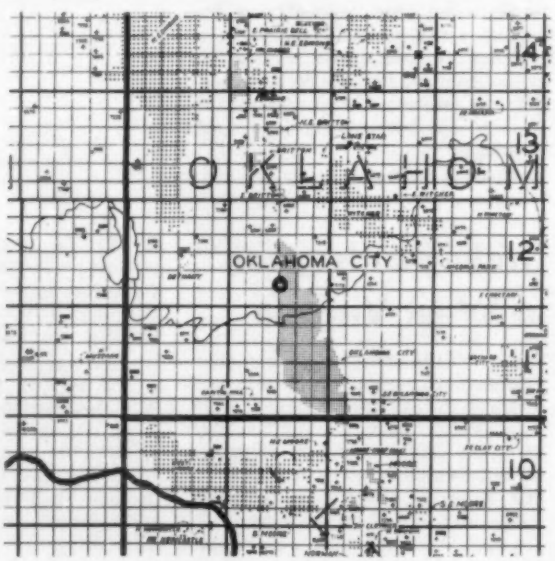
Perry Fulk 1 Rosenau, SE SW SE 36-3s-4w, between Albion and Pulaski pools, cased and cemented 5½-in. string at 4,281 ft. after drill-stem at 4,019-64 ft. logged small show free oil in Trenton.

More out-of-state concerns continued to come into the Albion area, especially from Illinois. with the exception of Carter Oil Co., Sun Oil Co., and Ohio Oil Co.'s recent acquisition of Aurora Gasoline Co., the southern Michigan play has been dominated by independents.

Production for the entire area topped 100,000 bbl. for a month in April the first time. Proration is standardized at 150 bbl. oil day but keyed to gas ratio, which has held a number of wells considerably below the oil maximum.

Excepting in the original Scipio field which has 700 acres proven and is 1 mile wide at its greatest east-west point, the several other pools still are confined to less than ½ mile wide and involve only 12 proven wells. So far, locations outside of the dolomite fracture have died on the vine.

## New Sooner map is out




**PORTION** of a new Oklahoma state oil and gas field map published by Oklahoma Oil Maps Co., 204 Third and Broadway Building, Oklahoma City. This is an excellent guide to new and old oil and gas fields in the state.

# Pennsylvania drilling statistics

FOR FIRST QUARTER OF 1959

| County— | Oil — No. wells | Oil — Footage | Gas — No. wells | Gas — Footage | Water input — No. wells | Water input — Footage | Dry holes — No. wells | Dry holes — Footage |
|---|---|---|---|---|---|---|---|---|
| Allegheny* | .. | .. | .. | .. | .. | .. | .. | .. |
| Armstrong | .. | .. | 20 | 62,184 | .. | .. | 1 | 3,316 |
| DD† | .. | .. | 2 | 1,955 | .. | .. | .. | .. |
| Clarion | .. | .. | 3 | 6,425 | .. | .. | 2 | 4,196 |
| DD† | .. | .. | 1 | 779 | .. | .. | .. | .. |
| Elk | .. | .. | 5 | 10,728 | .. | .. | .. | .. |
| Fayette | .. | .. | .. | .. | .. | .. | 1 | 3,633 |
| Indiana | .. | .. | 6 | 19,605 | .. | .. | 3 | 5,512 |
| DD† | .. | .. | 1 | 1,787 | .. | .. | .. | .. |
| Jefferson | .. | .. | 10 | 29,897 | .. | .. | 1 | 3,268 |
| McKean | 34 | 65,010 | .. | .. | 18 | 35,949 | .. | .. |
| Potter | .. | .. | 1 | 2,010 | .. | .. | .. | .. |
| Warren‡ | 3 | 2,738 | .. | .. | .. | .. | .. | .. |
| Washington | .. | .. | 1 | 2,897 | .. | .. | 1 | 2,990 |
| Westmoreland | .. | .. | 4 | 12,784 | .. | .. | .. | .. |
| DD† | .. | .. | 1 | 852 | .. | .. | .. | .. |
| Total | 37 | 67,748 | 50 | 146,530 | 18 | 35,949 | 9 | 22,915 |
| DD† | .. | .. | 5 | 5,373 | .. | .. | .. | .. |

| | |
|---|---|
| Total new wells drilled during first quarter in Pennsylvania | 115 |
| Total footage of new wells | 275,198 |
| Total wells drilled deeper | 5 |
| Total footage of wells drilled deeper | 5,373 |
| Total new storage wells | 1 |
| Total footage of new storage wells | 2,056 |
| Total footage of all wells | 282,627 |

*One storage well, 2,056 ft. †Drilled deeper. ‡Total daily production: two wells, 24 bbl.

# Film lot drilling results sparkle

UNIVERSAL Consolidated Oil Co.'s highly successful drilling program on the 20th Century Fox film lot in West Los Angeles was highlighted recently by an excellent completion in Tract 6193. The well, 9A Community, was brought in flowing 900 bbl. daily of 31°-gravity crude through a 24/64-in. choke from 450 ft. of zone above 10,902 ft.

This well is completed in a town-lot community lease adjoining the film lot but the drill site is on the lot itself. Universal was moving in another rig to begin drilling on the 109-acre Fox Hills community lease adjoining tract 6193 to the west.

# California County has new gas field

A NEW GAS FIELD discovery was indicated for the Los Medanos-Port Chicago area of Central California's Contra Costa County with completion of a Trico Oil & Gas Co. wildcat in NE NW 21-2n-1w.

The Trico gas well was completed in a shallow interval at 1,714-77 ft. for 4,300 M.c.f.d. through a ¾-in. choke. The well was drilled to 4,522 ft. before being plugged back to 2,397 ft. for the shallow zone discovery.

This new field find is located 2 miles southeast of the Los Medanos gas-field discovery well completed by McCulloch Oil Exploration of California, Inc. the first of last month. The McCulloch well, 1 McCulloch-Macson-Ginochio, was completed in the interval 1,872-1,908 ft. for 2,300 M.c.f.d. through a ½-in. choke.

# New discovery for North Tejon field

KERN COUNTY'S North Tejon field appeared to have turned up another significant new pool discovery in a Standard Oil Co. of California wildcat 1½ miles northeast of the Main area of the field.

Standard of California was running 7-in. casing in 338-9 Universal-Consolidated after testing an interval at 7,858-7,900 ft. The test was open 1 hour, 39 minutes with gas flowing at a rate of 500 M.c.f. daily and 500 bbl. daily of oil through a ½-in. choke. This wildcat was originally taken to 13,801 ft. It is in SE SW 19-11n-19w.

Universal Consolidated Oil Co. has a half interest in the 480 acres on which this wildcat was being drilled. Union Oil Co. of California, Superior Oil Co., Reserve Oil and Gas Co. and Franco Western Oil Co. all have offsetting acreage.

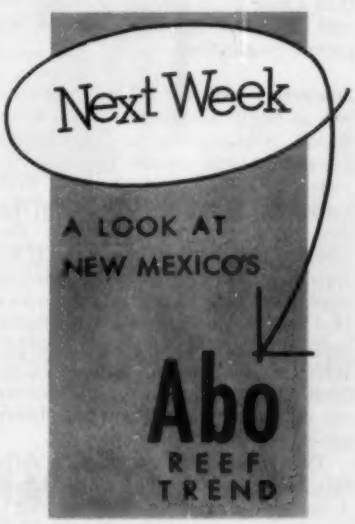
## Wildcatters stake interesting sites

A brief rundown on upcoming wildcats in California showed these slated to be drilled:

... **Texaco** will drill its third core hole on offshore Parcel D off Santa Barbara County. Texaco reportedly has already asked shipyards to submit design suggestions for this parcel based on the results of earlier core tests. The second core-hole reportedly flowed at a rate of 1,393 bbl. of oil daily on a brief test.

... **Ohio Oil Co.** was grading location for a 12,500-ft. wildcat staked for drilling 4 miles northwest of San Emidio Nose field in Kern County and 4 miles northeast of Los Lobos field. This Ohio wildcat falls about 10,000 ft. northwest of an historic wildcat started by Ohio in 1935 and which was abandoned 12 years later after several other operators took it over and drilled it to various depths.

Ohio originally drilled it to 7,595 ft. Texaco deepened it to 10,014 ft. in 1936. Continental tried next by deepening it to 10,424 ft. before it too abandoned the project. This was the first deep wildcat aimed at finding production in the San Emidio structure.



# South Texas field gets sixth strike

SOUTH TEXAS' North Alazan field, a multipay, multiple-completion giant, now has six wells. The newest addition to this Kleberg County field is Humble Oil & Refining Co.'s 11 King Ranch Alazan, a quadruple completion 1 mile due east of the discovery well in Las Comitas Grant.

Total production from four zones in the new well is 650 bbl. daily. Three of the zones are new pool discoveries for the field. Three zones flow through three strings of tubing, while the fourth flows through casing.

- The deepest new zone in this well is the H-86 Frio. From perforations at 7,885-91 ft. was 191 bbl. of 33.4°-gravity oil on ⅛-in. choke.
- The second new zone is at 7,727-32 ft. Flow was 14 bbl. daily on ⅛-in. choke. It is set up as the middle tubing phase.
- The third and upper tubing completion is from perforations at 7,102-15 ft. in the H-02 reservoir. Flow on ⅞-in. in choke was 300 bbl. of 41.3°-gravity oil daily.
- The shallow completion is the casing phase at 5,781-87 ft. in the F-77 reservoir, a new pool. This zone got 144 bbl. daily, 45.4° gravity, on ⅞-in. choke.

The 11 King Ranch Alazan discovery gives Humble its sixth well in this field. The multiple completions in the field give an actual total of 13 completions. This South Texas field appears to be a major find for the region. No well has been drilled less than a mile from another. The No. 12 well is now starting northeast of present production.

**A MAJOR** Frio sand field is developing in South Texas' King Ranch country.

**Discovery well . . .** The discovery well at North Alazan, Humble 6 King Ranch Alazan, was an unheralded December 1958 strike. It was completed as a dual producer from Frio sands—the H-08 and H-21 zones. The first zone had gas-condensate, the other had oil. Perforations in the H-08 zone at 7,080-90 ft. had an absolute open flow of 11,500 M.c.f.d. plus 58.4°-gravity condensate at a gas-liquid ratio of 69,930:1. This was the upper tubing phase. The H-21 zone at 7,220-30 ft. flowed 281 bbl. of 39.4°-gravity oil on ⅞-in. choke from the lower tubing.

Then came the second well early this year, the 7 King Ranch Alazan, 1 mile southeast of the discovery. This triple completion confirmed the oil discovery in the mother well, and then added two new and deeper oil sands, the H-28 Frio and the H-53 Frio. North Alazan's tremendous potential may give it Seeligson or Borregos field status if development continues as strongly as now.

**Future . . .** The North Alazan discovery, thought by many at first to be just another Frio find, is another example of the many multipay Frio fields still unfound in South Texas. One-pay Frio fields are rare. The Frio with its many pays (53 at Seeligson and 35 at Borregos) is probably the best potential source of new oil in South Texas. A huge portion of Texas is involved here—most of Kleberg, eastern Brooks, northern Hidalgo, all of Kenedy, and parts of Willacy and Cameron counties. This is no new oil province, but it is lacking in really deep exploration history.

Lying in the deepest part of the Rio Grande embayment near the center of the Southwestern Salt basin, this far-southern coastal and near-coastal region of South Texas is a must for future deep drilling. North Alazan's success should push the explorers off into the depths of the embayment.

# Panhandle drills set fast pace

THE Oklahoma Panhandle is in the midst of its busiest drilling spree to date. Beaver County leads the way with seven discovery prospects.

Apache Oil Corp. 1 Alexander is a new Morrow sand gas discovery in SE NW 17-2n-27eCM, 5 miles northeast of Logan and 2 miles southwest of Madison field. After treatment, the well made up to 5 M.M.c.f.d. on ¾-in. coke.

Sun Oil Co.'s 1 George S. Sargent is a Morrow discovery in SE NW 13-2n-20eCM, 4 miles southwest of Boyd and 1¼ miles southeast of a recent Morrow gas pool-opener. This well flowed oil and gas on drill-stem tests.

Home Stake Production Co. 1 Sims is a link well between Dower and Northwest Dower fields. This southwestern Beaver County well, NE NE 29-1n-21eCM, flowed 12,498 M.c.f.d. plus 21 bbl. distillate per million from perfortions at 7,957-92 ft. in Morrow.

The extreme southeast corner of the county has a new upper Morrow oil discovery. It is Sun Oil Co. 1 Ellis Getz in SE NW 15-1n-24eCM, 4 miles southeast of Elmwood Atoka field and 5 miles southwest of Como Morrow oil field.

Cherokee lime production was opened at El Paso Natural Gas Co.'s 1 Oklahoma-Jackson in NW NW NW

7-1n-28eCM, 3 miles southeast of Slapout and 4½ miles northeast of Southeast Logan Morrow gas field. The well made 2 bbl. of oil per hour on tests. Testing continues.

Mountain States Petroleum Corp. 1 Blakemore is a new Morrow gas discovery in C NW SE 9-4n-21eCM, 5 miles southeast of Turpin and 5 miles north of Northeast Boyd field. The well flowed 4 M.M.c.f.d., natural, from Morrow Pennsylvanian perforations.

Sun has another discovery in south-central Beaver at 1 Caleb Harper, SE NW 36-1n-24eCM, 9 miles southeast of Elmwood and 3 miles southeast of Sun's 1 Getz. Production is indicated in the Tonkawa Pennsylvanian.

## Kansas gets gas strike

Southwestern Kansas' Meade County has new Morrow Pennsylvanian gas production. Shamrock Oil & Gas Corp. found more than 60 ft. of pay at its 1 Boyer in NW NW SE 5-33s-28w, 8 miles southeast of Plains.

On drill-stem test at 5,528-75 ft. the well flowed 9,495 M.c.f.d. with recovery of 85 ft. clear distillate. On test at 5,578-5,633 ft. flow was 10,900 M.c.f.d. Location of this new pool opener is about 2 miles north of a recent Skelly Oil Co. Morrow discovery at Borchers.

# Discovery wells

**KANSAS**

Cowley County: Richard King et al. 1 Lovell, SE SE SW 9-35s-3e. IPP 64 BOPD, Bartlesville sand 3,460-64 ft., 40°. TD 3,903 ft. Opens Lovell field on Chautauqua arch.

Rawlins County: Skelly Oil Co. 1 Cahoj, SE SE NE 17-1s-34w. IPP 22 BOPH, Lansing-Kansas City Pennsylvanian 4,065-72 and 4,052-54 ft. TD 4,732 ft.

**WEST TEXAS**

Borden County: Trice Production Co. 1 Frank Miller, 1-30-T5N-T&P Sur., 10 miles northeast of Gail. Strawn discovery in Rafter Cross field. IP 260 BOPD, 14/64-in. choke, 38.5°, GOR 980:1, TP 730 psi., Strawn 8,198-8,218 ft. TD 8,520 ft. Elevation 2,538 ft. Ellenburger carried water.

Concho County: Hovgard & Fitzgerald 1 Bertha L. Cave, Sec. 296, Lehman Sur., 10 miles northwest of Eden. IP 4,400 M.c.f. of gas, GLR 120,000:1, 63°, Goen lime 3,499-3,505 ft. TD 3,813 ft., ground elevation 1,826 ft.

Gaines County: Champlin Oil & Refining Co., and W. A. Moncrief 1 Higginbotham Bros., Labor 1, League 302, Terry CSL Sur., 12 miles southeast of Seminole. IP 718 BOPD, 16/64-in. choke, 33.5° GOR nil, TP 125 psi., Devonian 12,737-50 ft. TD 12,752 ft., elevation 3,146 ft.

Continental Oil Co. 1 H. C. Schumacher, Labor 25, League 298, Reagan CSL Sur., 10 miles southeast of Seminole. Strawn discovery in Glasco field. IPP 102 BOPD, 42°, GOR 182:1, Strawn 11,142-60, 11,183-88 ft. Recompletion. Old TD 12,690 ft., PB 11,300 ft.

King County: Jake L. Hamon and Roy Guffey 1 Mary L. Hendrix, 87-13-H&TC Sur., 21 miles southeast of Guthrie. IPP 52 BOPD, 34°, GOR 275:1, Pennsylvanian 5,244-47, 5,237-41 ft. TD 5,300 ft., ground elevation 1,550 ft.

Martin County: Gordon P. Street 1 White, 21-35-T1S-T&P Sur., 3 miles southeast of Stanton. IP 420 BOPD, 16/64-in. choke, 43.5°, GOR 1,400:1, TP 700 psi., Wolfcamp 9,292-97 ft. TD 11,195 ft., elevation 2,575 ft.

Pecos County: Standard Oil Co. of Texas 2-D Rosa Mitchell, 22-100-EL&RR Sur., 24 miles southwest of Bakersfield; oil discovery on northeast side of Puckett gas field. IP 198 BOPD, 14/64-in. choke, 49°, GOR 2,870:1, TP 1,800 psi., Pennsylvanian 10,892-95 ft.; IP 4,850 M.c.f. gas, Devonian 11,798-11,802 ft. TD 12,073 ft., ground elevation 3,327 ft.

Saturn Drilling Co. 1 Mrs. Anna Campbell, 46-10-H&GN Sur., 6 miles south of Imperial. IP 23,750 M.c.f. of gas, Montoya 5,152-70 ft. TD 5,481 ft., ground elevation 2,459 ft.

Runnels County: Humble Oil & Refining Co. 2 Lange & Dierschke, Peter Zabel Sur. 131, 2 miles northeast of Rowena. New pay discovery in Rowena field. IP 179 BOPD, ¼-in. choke, 42°, GOR 192:1, TP 120 psi., Jennings 3,957-62 ft. TD 4,005 ft. Originally completed in Capps lime at 3,712-22 ft.

**WYOMING**

Fremont County: Sunray Mid-Continent Oil Co. 1-A Federal, NW SE 32-39n-91w. IPF 1 M.M.c.f.d., Wind River discovery, new field. TD 4,749 ft.

Sublette County: Belfer Natural Gas Co. 8 Unit, NE SW 32-27n-112w. IPF 4,300 M.c.f.d., Frontier discovery, new field. TD 7,358 ft.

## EVER WONDER ??

### Geoquestion...

Did you ever wonder where some basins got their names? Some examples are the Anadarko, Delaware, Palo Duro, Sedgwick, and Marietta. To those who work these areas, the names seem very familiar, but to outsiders they may seem distant and unknown.

### Geoanswer

Most basins take their names from a town, creek, mountain range, or state. Usually these geographic features are near the center of the deepest part of the basin. Anadarko took its name from the town of Anadarko, Okla.; Delaware basin is named for the Delaware Mountains of far West Texas; Palo Duro got its label from the creek of the same name in the Texas Panhandle; Sedgwick is named for the county of which Wichita is the seat; and, Marietta is named for a Love County town in extreme southern Oklahoma.

**This ball foretells less pump downtime**

Actual production records prove—Kennametal* API Balls and Seats stay on the job 3 to 5 times longer than "Super Alloys," and up to 20 times longer than steel. See Kennametal's new high-polish, "crystal finish" seat.

Kennametal Balls and Seats are stocked as replacement parts by most pump manufacturers—available for immediate delivery. Be sure to specify KENNAMETAL. For descriptive leaflet write to KENNAMETAL INC., Latrobe, Pa.

*Trademark

INDUSTRY AND KENNAMETAL ...Partners in Progress

Willard W. Wright

# Gob Turns Sales Wheelhorse

## . . . and Sun Oil's business soars. Bike-expert Wright grows apples, peaches, and roses, and thrives on business drives.

WILLARD W. WRIGHT has been on wheels all his life.

He was born to locomotion.

His father was a bicycle manufacturer, with a landoffice pedal-making business on the side. Adjusting mudguards and testing coaster brakes was a way of life for young Wright in grade-school days.

Sun Oil's marketing vice president, a peppery sales genius with a fullback build, still keeps a segment of the world on the go.

He is wheelhorse behind Sun Oil Co.'s revolutionary one-pump, multigrade gasoline program. How he got that way is an interesting story.

He was born in Buffalo, N. Y. The family moved to Port Huron, Mich. His father was rolling with the punches of progress, saw the wheel field sag and the automobile and truck move in. The family did another shift, to Philadelphia, and the Wright Roller Bearing Co. was formed. The bearings were for heavy-duty trucks and cars. Willard was a shop handyman.

**Navy lures him . . .** The family acquired a 140-acre peach and apple farm near Philadelphia. Four mules knew the loud "gee-haws" of young Wright.

His kinship with nuts and bolts and bearings led Wright to enroll in Drexel Institute of Technology. His goal—an engineering degree.

He was a bruising left half on the Drexel football team and was mastering the slide-rule sciences when war clouds loomed. He enlisted in the U. S. Navy in 1917, was commissioned an ensign at Annapolis, and went to sea.

Shedding his gob togs, Wright taught chemistry and physics and coached football, basketball, and baseball at Kennett, Pa., high school for 2 years. He pondered a teaching career.

**Tries hand at sales . . .** An old salt stopped him in his tracks. One summer day, Wright met his former Navy superior on a Philadelphia street. The officer, retired from military service, asked Wright to apply to Sun, where he had been employed. Wright did, was hired as a "smokestack," an industrial lube-oil salesman.

Machine shop routines had given no hint of hidden sales talent. But in 2 years, he went to Jacksonville as superintendent of sales for Sun in Florida and Cuba. In another 24 months, he was assistant manager of sales.

He never ran out of steam. With only 6 years Sun and sales experience behind him, he shifted north to Montreal to open a new marketing area in Nova Scotia, Ontario, and Quebec.

The same enthusiasm and gimmicks that made him a whiz down south clicked in the provinces. He spent 6 years in Canada, with sales mounting every year.

The rambling Wright was transferred to Boston as regional sales manager for New England. There he sold Sun products from 1935 to 1942. Uncle Sam beckoned again.

**Takes on PAW job . . .** This time, he was named manager of supply and distribution for the Petroleum Administration for War, handling wartime oil services in 17 eastern states.

In 1945, he returned to New England, was called to Philadelphia in 1949 as assistant general sales manager, 3 years later was tapped for the Sun board and in 1957 was placed on the executive committee and elected a vice president.

Intriguing and interesting things happened along the way.

While going to grade school near Philadelphia, Wright had taken a mild shine to a young girl ice-skating companion. On occasion, he'd helped her with her skates.

On a trip home in 1926, he attended a leap year dance. There he spied the girl whose skate key he'd carried. He

## ▶ ▶ ▶ Personals

**A. E. Hamalainen,** superintendent of Transcontinental Gas Pipe Line Corp.'s Chatham, Va., compressor station, has been named superintendent of the Eunice, La. compressor station. **H. E. Melton** has been transferred to Chatham from Kings Mountain, N. C., to succeed Hamalainen.

**A. A. More,** production engineer with Atlantic Refining Co. in Magnolia, Ark., has been transferred to Dallas as reservoir engineer.

**W. L. Snider,** assistant manager of the technological department at Shell Oil Co.'s Norco, La., refinery, has moved up to manager of the department.

**Daniel L. Sanders,** plant operator for Champlin Oil & Refining Co. in Yellowstone field, Oklahoma, has been promoted to production foreman and transferred to Buffalo, Okla.

**J. D. Edwards,** formerly southern district geologist in Shell Oil Co.'s Midland, Tex., division, has been named Midland division geologist.

and Miss Dorothy Thomas were wed.

Wright and Mrs. Wright live at St. Davids, Pa. He still has the 140-acre peach and apple farm at Collegeville, just 14 miles from his backyard.

**Multigrade his dish . . .** Dark eyebrows and gray, straight-back hair set off a genial grin and a folksy manner that have won him friends and business from Cuba to Canada and back again.

He's a leather-popping horseman, a casual golfer and does his fishing for keeps. He used to swing a healthy squash racket, still is a member of the Philadelphia Racquet club. He's a patron of Lankenau hospital, member of Bryn Mawr Presbyterian church, the Union League and the Philadelphia and Seaview Country clubs. He's very active in the API Marketing Division.

There is one staunch prop he has leaned on successfully. Wright isn't one to wear religion on his sleeve nor to boast a halo. Yet, his associates say he not only believes in whittling problems down to size with prayer—he has made it an unwavering part of his business, home and personal life.

This ex-sailor goes for flowers, too. He has 280 rose bushes and knows the prickly history of every one of them.

His secret of success? This isn't the time, says he, to idle your motor and appraise. The present's too busy an era.

Wright is hammering away at a new slam-bang sales campaign that puts his 37 years of Sun exploits in the shade. He's reselling hundreds of thousands of people on a new device of ordering at the pump the octane numbers they want in their gasoline.

He is tackling the chore like a boy would a new bike.

As anchor man in the Sun team of 35,000 people pushing multigrade shopping techniques, Wright is hitting on all cylinders in the most furious, sales push of his career. He thrives on it.

There's time awaiting, years ahead, to sit in the orchard and squeeze a fuzz-covered peach. That's not for now. There's shop to keep.

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**R. W. Banner,** geologist in Salt Lake City for Texaco, Inc., has been promoted to district geologist in Denver.

**Harmon M. Knight,** acting group leader at American Oil Co.'s Texas City refinery, research and development department, has been promoted to group leader.

**R. D. Arthur,** head roustabout for Pan American Petroleum Corp. in Silver, Tex., has been transferred to Strawn, Tex., as field foreman.

**Howard Gustafson,** formerly assistant manager of Phillips Petroleum Co's Chicago sales division, has been appointed superintendent of marketing, Canadian operations.

**Dr. Gus E. Montes,** formerly chief technologist with U. S. Industrial Chemicals Corp., has joined Northern Natural Gas Co. as technical director of the gas products development department.

**C. Arnold Brown,** formerly chief petroleum engineer for Crawford Production Co., has joined the engineering staff of Keplinger & Wanenmacher, Tulsa petroleum engineering and consulting firm.

**Hugh U. McBirney,** assistant northern region marketing manager for Continental Oil Co. in Kansas City, has been appointed Chicago division marketing manager. He succeeds **Warner Tyler,** recently named industrial relations manager in Kansas City.

**W. F. Allmon,** district mechanical engineer for Shell Oil Co., has been transferred to Elk City, Okla., from Woodward, Okla. **A. B. Ferguson,** production foreman in Elk City, has been reassigned to Shell Oil Co. of Canada, Ltd. **I. L. Shoffner,** production foreman in Ardmore, Okla., has moved to Elk City, replacing Ferguson.

**Cecil A. Colville,** district operating superintendent for Sun Oil Co. in Midland, Tex., has been appointed administrative assistant to management of the company's southwest production division, Dallas. **E. Lloyd Kownslar,** formerly assistant district superintendent in Corpus Christi, Tex., will succeed Colville in Midland. In other changes, **Jake B. Higginbotham,** area superintendent in Robert Lee, Tex., will succeed Kownslar in Corpus Christi. **Robert K. Beggs,** assistant area superintendent in charge of the Gainesville, Tex., area, has been promoted to superintendent in Robert Lee, replacing Higginbotham. Beggs will be succeeded by **Claud W. Underwood,** assistant district superintendent at McAllen, Tex. **Cleo Alexander,** area superintendent in Sun field, has been transferred to McAllen to replace Underwood. **Frank A. Lawrence,** assistant to the regional superintendent in Dallas, has been named assistant area superintendent in Sun field.

## ▶▶▶ Personals

**W. C. Smith,** chemist with Esso Research & Engineering Co., has been promoted to research associate.

**Margaret M. Pendleton,** geologist with Continental Oil Co., has been transferred to Denver from Billings, Mont.

**Dr. Quentin E. Thompson,** research chemist in Monsanto Chemical Co.'s organic chemicals division in St. Louis, has been promoted to scientist.

**George F. Berry** of Continental Oil Co.'s Los Angeles region exploration staff, has been promoted to regional geophysicist.

**R. L. Flanders** and **M. W. Savage** have been appointed engineering associates at California Research Corp.'s Richmond, Calif., laboratory. **C. D. McLean** has been appointed group supervisor for products research and technical service at Cal Research's El Segundo, Calif., laboratory.

WATTS

**Prentice R. Watts, Jr.,** formerly superintendent of Aztec Oil & Gas Co.'s Hobbs, N. M., district, has been promoted to superintendent of drilling, production, and engineering for the company, a new position. He will headquarter in Dallas. Watts will be succeeded in Hobbs by **Lester L. Duke,** geologist. **John Elliott,** geologist, has been transferred to Hobbs from Dallas. Watts had been Hobbs superintendent since 1950.

**E. C. Wells, Jr.,** formerly an assistant manager of Carter Oil Co.'s production department, has been named regional coordinator, Western Hemisphere production, for Standard Oil Co. (N. J.) in New York. **W. F. Eiting, Jr.,** assistant manager of Carter's production department, will take over additional responsibilities which he formerly shared with Wells. Also, **Hugh H. Goerner,** district production superintendent in Great Bend, Kans., for Carter, has been named assistant to the production department manager in the Tulsa headquarters office. **J. D. Simmons,** division engineer in Mattoon, Ill., will succeed Goerner in Great Bend. **J. H. Norman,** assistant division engineer in Mattoon, will succeed Simmons as division engineer there.

# ▶ ▶ ▶ Personals

**Fred Powell,** vice president, Standard Oil Co. of California, Western Operations, Inc., has been elected president and chief executive officer of California Chemical Co., California Standard subsidiary. He will coordinate activities of the parent company's two chemical subsidiaries, Oronite Chemical Co. and California Spray-Chemical Corp. Powell is a former president of California Research & Development Corp. **W. H. Shiffler,** a vice president of California Research Corp., has been named vice president of California Chemical. California Chemical was formed in 1957 to consolidate the parent company's chemicals operations. It has not had a full-time operating head, but **G. L. Parkhurst,** vice president and a director of California Standard, has acted as both president and chairman. Parkhurst will continue as chairman. Oronite and Calspray will operate as subsidiaries of California Chemical under the new setup. **T. G. Hughes** and **A. W. Mohr** will continue as presidents of Oronite and Calspray and as vice presidents of California Chemical. Powell, Hughes, Mohr, and Shiffler will make up the California Chemical management committee.

POWELL

**Fred A. Crane,** superintendent of Sinclair Pipe Line Co.'s right-of-way and claim department, has been elected national chairman of the American Right-of-Way Association.

**J. B. Stephen,** general manager of the Montreal sales department of Texaco Canada, Ltd., has been appointed assistant to the president of the company and will be responsible for coordination of all company activities in Ontario. He will headquarter in Toronto.

**E. A. Galvin,** general manager of Medallion Petroleums, Ltd., has been elected president and a director of New Superior Oils of Canada, Ltd. Newly elected directors of the company include **J. D. Petrie,** president of Medallion, who will also be vice president of New Superior; **John Drybrough;** and **H. R. Whittall.** Drybrough and Whittall are directors of Medallion. The changes are the result of Medallion's recent purchase of an interest in New Superior.

**H. D. McHenry,** vice president, secretary, and general counsel of Southern Natural Gas Co., has been elected executive vice president.

**John A. Boege** has been named assistant to the director of manufacturing for General Petroleum Corp. Boege has been with GP since 1930.

**Reynolds Girdler,** director of public relations and advertising, has been elected a vice president of Sinclair Oil Corp. He has been with the company since 1952.

**William F. Nicodemus,** formerly with Ralph E. Davis & Associates, Houston consulting firm, has joined the Fourth National Bank in Wichita as petroleum engineer in the bank's oil loan department.

**Ben C. Ball,** supervisor of the bulk oil shipping unit at Gulf Oil Corp.'s Port Arthur, Tex., refinery, has been transferred to Houston to join the staff of **B. H. Barnes,** vice president in charge of domestic manufacturing. Ball will be assigned to work on cost and economics studies on the departmental level.

**Porter L. Versfelt, Jr.,** formerly research geologist with Alex McCoy Associates in Tulsa, has joined Reservoir Analysts, Dallas consulting firm, as chief geologist and manager of the new Tulsa office. **W. W. Yankie** and **Angelo Chatas,** partners in the firm, will continue to make headquarters in Dallas.

**T. E. Hobbs,** exploration superintendent for General Petroleum Corp.'s Rocky Mountain division, has been elected president of the Salt Lake City Petroleum Club. He succeeds **George T. Hansen, Jr.,** Highland Oil Co. Other officers are **James A. Wilkins,** El Paso Natural Gas Co., first vice president; **Frank Neighbor,** Sun Oil Co., second vice president; **William O. Darley,** independent, secretary; and **Allen N. Henderson,** independent, treasurer.

**W. F. Nelson,** reservoir engineer for Shell Oil Co. in Corpus Christi, Tex., has been transferred to Houston as petrophysical engineer. **L. P. Caley,** junior mechanical engineer in the Denver area, has been promoted to mechanical engineer in Houston. **G. L. Godfrey,** junior exploitation engineer in Denver, has been named exploitation engineer in Houston, and **H. J. Ritch,** formerly junior exploitation engineer in Houston, has been named exploitation engineer in Kilgore, Tex.

**Walter A. Cronkright** has joined M. W. Kellogg Co.'s Jersey City, N. J., research and development laboratory as research chemist. Cronkright was formerly with Allied Chemical & Dye Corp.

**Maurycy Bloch,** formerly vice president and general manager of Warwick Wax Co., a subsidiary of Sun Chemical Corp., has been named president of the newly formed Western Petrochemical Corp. Assets of Warwick Wax were recently acquired from Sun by Western Petrochemical. Warwick will operate as a division of Western.

**W. L. Culbertson,** assistant manager of Phillips Petroleum Co.'s natural gasoline department, has moved up to manager. He succeeds **G. W. McCullough,** who was recently promoted to vice president, natural gasoline. A graduate of Kansas State University, Culbertson joined Phillips in 1939.

**Otis Anderson,** formerly production manager for Scurlock Oil Co., Houston, has been named chief engineer of the Oklahoma division of Jocelyn - Varn Oil Co., Wichita. Anderson will headquarter in Oklahoma City. A graduate of the University of Tulsa, Anderson was with Midstates Oil Corp. before joining Scurlock.

**E. A. Kelso** has been named a senior research specialist in the research and development division of Humble Oil & Refining Co.'s Baytown, Tex., refinery. **A. M. Souby** has been promoted to section head there. **C. Phillips** has been named a research specialist, and **T. S. Farmer** becomes a senior research chemical engineer.

**Howard C. Pyle,** president of Monterey Oil Co. and 1959 president of American Institute of Mining, Metallurgical, and Petroleum Engineers, received an honorary doctor of engineering degree at Colorado School of Mines' graduation exercises recently. Pyle was principal speaker at the school's commencement.

**M. A. (Andy) Long** has been appointed district geologist in Cabot Carbon Co.'s new Denver exploration office. **M. W. Rafferty** has been named district landman in Denver. Cabot has also opened a new exploration office in Lafayette, La., with **A. S. Bonner, Jr.,** as district geologist, and **Joe P. Maxey** as district landman.

**John E. Brewster,** formerly southern division manager for Indiana Oil Purchasing Co. in Tulsa, has joined Commonwealth Oil Refining Co., Inc., as manager of supply and transportation. He will headquarter in New York. Brewster entered the oil industry in 1948 with Root Petroleum Co. He was with Pan-Am Southern Corp. in New Orleans before joining Indiana Oil Purchasing.

**Herbert G. Twaddle,** shift supervisor at Phillips Chemical Co.'s Coulee Ammonia plant, Kennewick, Wash., has been promoted to computer engineer and transferred to the company's Adams terminal, Pasadena, Tex.

**G. F. Pirsig,** area geophysicist in Houston for Shell Oil Co., has been reassigned to Shell Oil Co. of Canada, Ltd., in the same capacity. **R. B. O'Connor,** Houston geophysicist, will succeed Pirsig there.

**Charles Sanders,** Phillips Petroleum Co. district development geologist in Casper, Wyo., has been assigned to the geological staff in Bartlesville, Okla. **Larry O'Brien** will move to Casper from Bartlesville to succeed Sanders.

**Herbert N. Friedlander** and **Kenneth C. Peterson** have been appointed section leaders in the Whiting, Ind., research laboratories of Standard Oil Co. (Ind.).

**Carl F. Roeder,** production foreman for Chanslor-Western Oil & Development Co., has been named superintendent of the company's San Joaquin (California) division. He succeeds **Roy E. Sallady,** who has retired.

**W. L. Hodges,** Stekoll Petroleum Corp.'s general field superintendent for production, has been elected vice president, production. **Art Woerheide,** chief engineer, becomes vice president, engineering, and **Ronald M. Hawkins,** who recently joined Stekoll, has been named vice president, finance.

**Chalmer G. Kirkbride,** executive director of Sun Oil Co.'s research and engineering department, and president of AviSun Corp., has received an honorary Doctor of Science degree from Beaver College, Jenkintown, Pa. Kirkbride delivered the main address at Beaver's recent commencement exercises.

**R. O. Swayze,** vice president and director of production for General Petroleum Corp., has been awarded an honorary professional engineer of mines degree from Missouri School of Mines and Metallurgy, Rolla. Swayze is a 1920 graduate of the school.

## ▶▶▶ Personals

**W. K. Venatta,** manager of Oronite Chemical Co.'s Oak Point, La., plant, has been named manager of the company's manufacturing department. He will headquarter in San Francisco. Also, **J. T. Deane,** vice president of manufacturing and a director of the company, will retire November 1. Venatta joined Oronite, petrochemical subsidiary of Standard Oil Co. of California, in 1948. He was with California Research Corp. before that time. He is a graduate of the University of Wisconsin. Deane, retiring Oronite vice president, has been with Standard of California and its subsidiaries, including Bahrein Petroleum Co., The California Co., California Oil Co., and Oronite, for 35 years.

VENATTA

**F. H. Taylor** has been named senior operations engineer in Shell Oil Co.'s New York production department. Taylor has been on special assignment in New York for the past year. He was special assistant to the production manager of the Midland, Tex., area, and Casper, Wyo., division production manager before that time.

## ▶▶▶ Deaths

**John Cromwell Lincoln,** 92, founder of Lincoln Electric Co., died May 25 at his home in Scottsdale, Ariz. A graduate of Ohio State University, Lincoln founded Lincoln Electric in 1893. He was president of the company until 1928, when he became board chairman. Lincoln was a pioneer in the development of ductile welds. His company today furnishes a large percentage of the welding equipment and materials used by the oil and gas industry. He was a champion of the single-tax economic theory and ran for vice president of the United States on the Commonwealth Land Party ticket in 1924. His brother, **James F. Lincoln,** is now chairman of Lincoln Electric.

**Alton Frank (Charlie) Davis,** 69, vice president and secretary of Lincoln Electric Co., died May 25 at his home in Cleveland. Davis joined Lincoln Electric after graduation from Ohio State University in 1914. He became a director and vice president of the company in 1925 and secretary in 1938. Davis' death followed by one day that of J. C. Lincoln, founder of Lincoln Electric.

**H. E. (Ike) Lowrey,** vice president in charge of Continental-Emsco Co.'s export division, died June 6 after a heart attack. A graduate of Louisiana Polytechnic Institute, Lowrey joined Continental-Emsco in 1935. He was manager of Venezuelan operations before being promoted to manager of the export division in New York in 1955.

**Rollin A. Waltz,** 67, retired inventory supervisor for Pan American Petroleum Corp., died June 4 in Houston. Waltz retired from Pan Am's Tulsa office in 1947.

**John William Ducker,** 63, retired geologist, died June 3 in Mineral Wells, Tex., after a heart attack.

**Albert L. Walters,** 61, West Coast secretary of the Liquefied Petroleum Gas Association and managing director of the Western Liquefied Gas Association, died June 9 in Portland, Ore., after a heart attack. Walters was in Portland attending a convention of LPGA.

**James E. Bradshaw,** 53, former vice president of Glenn Drilling Co., died June 8 in a Tulsa hospital after a heart attack. Bradshaw sold his interests in Glenn Drilling and resigned as vice president last year because of illness. He had been with the drilling firm for 24 years.

**Jack D. Bryan,** 59, retired drilling contractor, died June 2 in Los Angeles.

**Louis E. Conway,** 62, Southern Counties Gas Co. harbor division superintendent since 1951, died June 2 in Los Angeles.

▶ ▶ ▶ Statistical Section

# Calm nerves are needed to steer a steady price course

## . . . in the face of excess inventories

BY JOHN C. CASPER

SOFT PRODUCT MARKETS are the direct result of a powerful combination—excessive inventories and the jitters. Either one may produce a few scattered price cuts without support from the other. But, working together, they can create a wide area of price blight.

First, take a look at major-product inventories for two of the big supply-demand areas. These are Group 3—North Central area and the Gulf-East Coast area.

Combined gasoline inventories for the Gulf-East Coast market area amounted to about 85 million barrels at the end of May. This represented a gain of about 3.4 million barrels or 5.9% over last year. Compared with 1957, stocks are up about 7.4%.

Gulf-East Coast stocks of kerosine are up 22.1% from last year, but are down 6.1% from the level reported for the end of May 1957.

Distillate stocks are up 27.8% from last year and 5.6% from May 1957. Residual inventories are about the same as last year but are up almost 10% over 1957.

Cargo prices for gasoline on the Gulf Coast are lower than they were at the first of the year. Late in December, regular gasoline was normal at about 10.5 cents a gallon. Market pressure developed and prices skidded to about 10.25 cents early in January. For a short period, the low of the market was down to 10.00 cents, but a strike at one of the large refineries cut the inventory surplus enough to raise the price to 10.5 cents by the middle of April. Since that time, prices have been sagging.

Formal quotations dropped to 10.25 cents at the end of May, but current market information places the low for regular at about 10.00 cents.

Spot prices on the gulf were about 10.00 cents last year at this time, but these are the lowest first-of-June prices since the recession of 1949. June prices that year were 9.5 cents, but quotations were for lower-octane fuel and no adjustment has been made for inflation. In terms of present dollar values, that 9.5-cent price in 1949 would be comparable to a price of 12.0 cents today.

Quotations for No. 2 fuel on the Gulf Coast are about in line with seasonal declines of past years, but there has been no gradual increase to cover inflation.

### A quick look at the highlights . . .

| | LATEST WEEK | Change from WEEK AGO | | Change from YEAR AGO | |
|---|---|---|---|---|---|
| Production | 7,042,540 | DOWN | 137,170 | UP | 783,350 |
| Crude stocks | 262,520,000 | UP | 240,000 | DOWN | 6,274,000 |
| Completions | 978 | DOWN | 67 | UP | 99 |
| Refinery runs | 8,280,000 | UP | 392,000 | UP | 590,000 |
| Gasoline stocks | 203,605,000 | UP | 465,000 | UP | 10,580,000 |
| Kerosine stocks | 25,063,000 | UP | 1,033,000 | UP | 2,719,000 |
| Distillate stocks | 102,496,000 | UP | 4,952,000 | UP | 9,459,000 |
| Residual stocks | 55,615,000 | UP | 946,000 | DOWN | 7,195,000 |
| Four-product stocks | 386,779,000 | UP | 7,396,000 | UP | 15,563,000 |
| Total imports | 1,383,700 | UP | 26,500 | DOWN | 79,000 |

### Inland Markets

Recent erratic gasoline prices in the Group 3 area may have been influenced some by high inventories, but much of the shifting can be charged to market nervousness.

Gasoline stocks in Mid-Continent and North Central districts are up about 3.7% over last year and 3.0% over May 1957. At least part of these gains were necessary to meet increased demand. The net surplus has not been large enough to create the general market disturbance of the past few months.

Back early in May, there were reports of three spot sales of gasoline averaging about 50,000 bbl. each. These were below-the-market sales through brokers. While the sellers did not release prices, market rumors placed the average well below 11.00 cents a gallon.

These sales were small compared with total normal movement of gasoline in the area. The combined volume from the three sales represented less than three-tenths of 1% of gasoline inventories in the area. It amounted to only 12% of a single day's gasoline production in District 2. But, the sales started other marketers looking for signs of a market break.

Gasoline markets were unstable during most of May. Large unbranded jobbers were buying on a day-to-day basis.

The downward drift of spot prices increased the spread between wholesale refinery prices and tank-wagon posting for gasoline. This increased spread tended to favor the unbranded and private-brand jobber or service station.

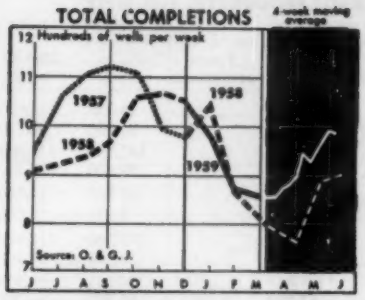
If the branded marketer looses too much gasoline volume to unbranded service stations, he must adjust prices to regain at least part of his business. This means a cut in tank wagon prices.

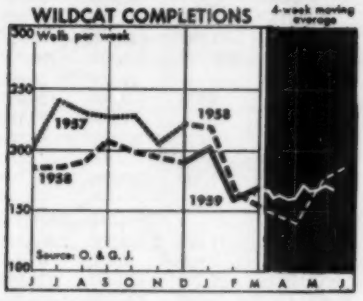
The unstable spot market has not as yet forced a general cut in tank wagon prices in District 2, but there has been market speculation on how much additional pressure it would take to cause a general drop.

There are two factors that may bring a degree of stability to the District 2 gasoline market. First, Regular gasoline now going into the Great Lakes Pipeline, is 91 octane compared with 89 octane, the standard for regular grade since June 1957. Discounts may be confined to the remaining 89-octane fuel in storage.

Also, there have been rumors of interrefinery sales at near normal prices for the past week. Large refiner-marketers may have decided to meet part of their summer demands through purchases of surplus gasoline rather than by increased refinery runs.

The result is a slightly better market undertone.




# Active Rotary Rigs

| | 6-8-59 | 6-1-59 | 6-9-58 |
|---|---|---|---|
| Alabama | 7 | 7 | 5 |
| Arkansas | 14 | 16 | 24 |
| Arizona | 3 | 2 | 0 |
| California | 104 | 103 | 78 |
| Land | 99 | 98 | (*) |
| Offshore | 5 | 5 | (*) |
| Colorado | 49 | 44 | 36 |
| Florida | 3 | 3 | 1 |
| Land | 2 | 2 | 1 |
| Offshore | 1 | 1 | ... |
| Georgia | .. | .. | 1 |
| Illinois | 41 | 35 | 52 |
| Indiana | 11 | 4 | 10 |
| Iowa | 3 | 3 | 3 |
| Kansas | 140 | 132 | 141 |
| Kentucky | 8 | 6 | 12 |
| Louisiana | 380 | 368 | 270 |
| North | 33 | 36 | 35 |
| S.-Inland waters | 157 | 149 | (†) |
| S.-Land | 127 | 123 | 193 |
| Offshore | 63 | 60 | 42 |
| Maryland | 0 | 0 | 0 |
| Michigan | 25 | 26 | 5 |
| Mississippi | 67 | 62 | 39 |
| Missouri | 1 | 1 | 0 |
| Montana | 24 | 16 | 15 |
| Nebraska | 27 | 29 | 24 |
| Nevada | 1 | 1 | 0 |

| | 6-8-59 | 6-1-59 | 6-9-58 |
|---|---|---|---|
| New Mexico | 137 | 131 | 123 |
| New York | 1 | 1 | 2 |
| North Dakota | 35 | 31 | 34 |
| Ohio | 2 | 2 | 0 |
| Oklahoma | 243 | 239 | 173 |
| Oregon | 0 | 0 | 1 |
| Pennsylvania | 9 | 11 | 10 |
| South Dakota | 2 | 1 | 0 |
| Texas | 779 | 773 | 643 |
| S.-Inland waters | 5 | 6 | (†) |
| S.-Land | 195 | 180 | 126 |
| Offshore | 1 | 0 | 3 |
| North-East | 161 | 158 | (*) |
| West Central | 255 | 265 | (*) |
| West | 162 | 164 | (*) |
| Utah | 30 | 29 | 36 |
| Washington | 1 | 0 | 0 |
| West Virginia | 8 | 6 | 8 |
| Wyoming | 90 | 84 | 57 |
| Total U. S. | 2,245 | 2,166 | 1,803 |
| Western Canada | 149 | 148 | 155 |
| Eastern Canada | 0 | 0 | 3 |
| Grand Total | 2,394 | 2,314 | 1,961 |

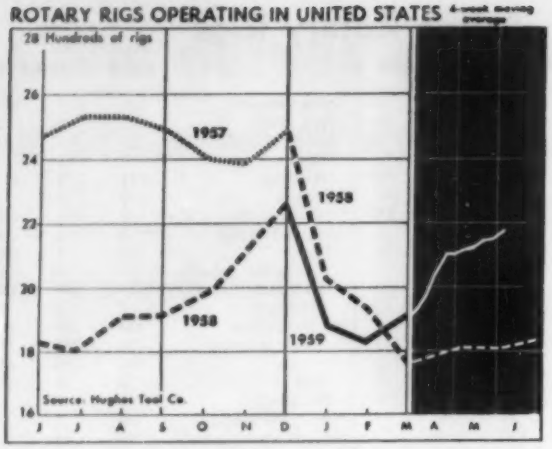
Hughes Tool Co. report. *Comparisons not available due to change in method of reporting. †Included in South-Land.

## WEEKLY WELL COMPLETIONS . . . WEEK ENDED JUNE 6, 1959

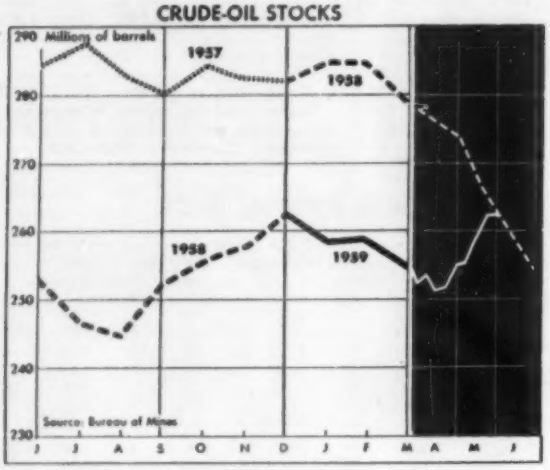
| | Total wells | | | | | | | Cum. | | Total wildcats | | | | | Cum. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | Crude | Cond. | Gas | Dry | Service | Footage | 1959 | 1958 | Total | Crude | Cond. | Gas | Dry | 1959 | 1958 |
| Alabama | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 43 | 35 | 0 | 0 | 0 | 0 | 0 | 7 | 13 |
| Arkansas | 9 | 5 | 0 | 0 | 4 | 0 | 26,689 | 350 | 280 | 1 | 0 | 0 | 0 | 1 | 58 | 70 |
| California | 34 | 15 | 0 | 2 | 17 | 0 | 144,155 | 653 | 772 | 14 | 0 | 0 | 0 | 14 | 155 | 159 |
| Colorado | 15 | 1 | 0 | 2 | 12 | 0 | 64,210 | 306 | 315 | 8 | 0 | 0 | 0 | 8 | 180 | 168 |
| Illinois | 39 | 25 | 0 | 0 | 14 | 0 | 83,065 | 895 | 818 | 5 | 3 | 0 | 0 | 2 | 150 | 171 |
| Indiana | 21 | 5 | 0 | 0 | 16 | 0 | 32,367 | 309 | 282 | 6 | 1 | 0 | 0 | 5 | 103 | 107 |
| Kansas | 39 | 24 | 1 | 5 | 27 | 2 | 223,115 | 1,727 | 1,554 | 15 | 0 | 0 | 1 | 14 | 383 | 316 |
| Kentucky | 99 | 82 | 0 | 0 | 13 | 4 | 59,567 | 874 | 388 | 1 | 0 | 0 | 0 | 1 | 68 | 45 |
| Louisiana | 81 | 46 | 4 | 5 | 26 | 0 | 635,249 | 1,516 | 1,425 | 4 | 0 | 0 | 0 | 4 | 189 | 209 |
| North | 30 | 17 | 0 | 4 | 9 | 0 | 90,922 | 539 | 480 | 0 | 0 | 0 | 0 | 0 | 79 | 76 |
| South | 42 | 21 | 3 | 1 | 17 | 0 | 453,323 | 812 | 748 | 4 | 0 | 0 | 0 | 4 | 104 | 118 |
| Offshore | 9 | 8 | 1 | 0 | 0 | 0 | 91,004 | 165 | 197 | 0 | 0 | 0 | 0 | 0 | 6 | 15 |
| Michigan | 7 | 4 | 0 | 0 | 3 | 0 | 19,707 | 246 | 164 | 0 | 0 | 0 | 0 | 0 | 56 | 53 |
| Mississippi | 8 | 3 | 0 | 0 | 5 | 0 | 89,200 | 268 | 159 | 4 | 0 | 0 | 0 | 4 | 122 | 83 |
| Montana | 5 | 2 | 0 | 0 | 3 | 0 | 17,310 | 120 | 154 | 1 | 0 | 0 | 0 | 1 | 42 | 65 |
| Nebraska | 14 | 4 | 0 | 0 | 10 | 0 | 84,384 | 336 | 280 | 5 | 1 | 0 | 0 | 4 | 153 | 134 |
| New Mexico | 35 | 22 | 0 | 9 | 4 | 0 | 99,916 | 789 | 811 | 3 | 0 | 0 | 0 | 3 | 87 | 109 |
| West | 18 | 7 | 0 | 9 | 2 | 0 | 52,627 | 351 | 375 | 1 | 0 | 0 | 0 | 1 | 26 | 48 |
| East | 17 | 15 | 0 | 0 | 2 | 0 | 47,289 | 438 | 436 | 2 | 0 | 0 | 0 | 2 | 61 | 61 |
| New York | 21 | 12 | 0 | 1 | 1 | 7 | 27,580 | 143 | 239 | 1 | 0 | 0 | 0 | 1 | 13 | 16 |
| North Dakota | 9 | 6 | 0 | 0 | 3 | 0 | 46,235 | 210 | 183 | 3 | 0 | 0 | 0 | 3 | 44 | 61 |
| Ohio | 25 | 14 | 0 | 4 | 5 | 2 | 66,484 | 407 | 442 | 0 | 0 | 0 | 0 | 0 | 9 | 5 |
| Oklahoma | 106 | 63 | 3 | 5 | 33 | 2 | 402,975 | 2,511 | 2,851 | 16 | 5 | 0 | 1 | 10 | 385 | 383 |
| Pennsylvania | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 212 | 184 | 0 | 0 | 0 | 0 | 0 | 3 | 6 |
| Texas | 358 | 213 | 10 | 22 | 108 | 5 | 1,597,728 | 8,203 | 7,809 | 65 | 5 | 3 | 0 | 57 | 1,525 | 1,607 |
| Dist. 1 | 22 | 9 | 0 | 2 | 11 | 0 | 53,654 | 489 | 439 | 11 | 0 | 0 | 0 | 11 | 135 | 178 |
| Dist. 2 | 13 | 1 | 2 | 2 | 8 | 0 | 94,182 | 348 | 323 | 5 | 0 | 0 | 0 | 5 | 95 | 86 |
| Dist. 3 | 21 | 11 | 3 | 1 | 6 | 0 | 161,603 | 491 | 565 | 4 | 0 | 2 | 0 | 2 | 108 | 115 |
| Dist. 4 | 33 | 11 | 2 | 10 | 9 | 1 | 157,253 | 547 | 516 | 6 | 0 | 0 | 0 | 6 | 140 | 156 |
| East | 26 | 16 | 1 | 0 | 9 | 0 | 127,337 | 474 | 534 | 4 | 1 | 0 | 0 | 3 | 97 | 151 |
| Dist. 7-B | 36 | 16 | 0 | 1 | 19 | 0 | 121,059 | 1,144 | 1,012 | 10 | 1 | 0 | 0 | 9 | 305 | 286 |
| West | 122 | 97 | 1 | 1 | 21 | 2 | 607,277 | 2,566 | 2,322 | 15 | 1 | 1 | 0 | 13 | 314 | 320 |
| Dist. 9 | 67 | 41 | 0 | 2 | 22 | 2 | 178,803 | 1,555 | 1,558 | 8 | 2 | 0 | 0 | 6 | 280 | 269 |
| Dist. 10 | 18 | 11 | 1 | 3 | 3 | 0 | 96,560 | 589 | 540 | 2 | 0 | 0 | 0 | 2 | 51 | 46 |
| Utah | 3 | 2 | 0 | 0 | 1 | 0 | 16,986 | 153 | 190 | 1 | 0 | 0 | 0 | 1 | 42 | 35 |
| West Virginia | 8 | 2 | 0 | 4 | 1 | 1 | 26,905 | 310 | 290 | 0 | 0 | 0 | 0 | 0 | 9 | 9 |
| Wyoming | 22 | 12 | 0 | 4 | 6 | 0 | 123,787 | 348 | 313 | 3 | 0 | 0 | 0 | 3 | 110 | 89 |
| Miscellaneous | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 | 40 | 0 | 0 | 0 | 0 | 0 | 22 | 34 |
| Total U. S. | 978 | 562 | 18 | 63 | 312 | 23 | 3,887,614 | 20,960 | 19,978 | 156 | 15 | 3 | 2 | 136 | 3,915 | 3,947 |
| Previous week | 1,045 | 582 | 25 | 61 | 345 | 32 | 3,857,301 | ..... | ..... | 170 | 19 | 3 | 3 | 145 | ..... | ..... |
| Cum. 1959 | 20,960 | 10,685 | 524 | 1,516 | 7,677 | 558 | 87,341,148 | ..... | ..... | 3,915 | 397 | 56 | 118 | 3,344 | ..... | ..... |
| Cum. 1958 | 19,978 | 9,934 | 500 | 1,487 | 7,585 | 472 | 84,562,157 | ..... | ..... | 3,947 | 373 | 69 | 125 | 3,380 | ..... | ..... |
| Western Canada | 64 | 44 | 0 | 10 | 10 | 0 | 279,163 | 1,024 | 981 | 8 | 1 | 0 | 3 | 4 | 350 | 347 |
| Ontario | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 86 | ..... | .... | .... | .... | .... | .... | ..... | ..... |

## PRODUCTION

### ROTARY RIGS OPERATING IN UNITED STATES




### CRUDE-OIL STOCKS




### CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

| | 5-30-59 | 5-23-59 | 5-31-58 |
|---|---|---|---|
| Pennsylvania | 2,476 | 2,455 | 2,932 |
| Other Appalachian | 1,706 | 1,706 | 1,461 |
| Illinois, Indiana, Michigan | 9,108 | 9,036 | 10,968 |
| Nebraska and North Dakota | 2,537 | 2,689 | 2,254 |
| Kansas | 10,324 | 10,100 | 10,467 |
| Oklahoma | 17,162 | 16,868 | 17,148 |
| Arkansas | 1,838 | 1,765 | 2,357 |
| Louisiana | 18,984 | 19,388 | 17,081 |
| North | 3,203 | 3,367 | 3,000 |
| South | 15,781 | 16,021 | 14,081 |
| Mississippi, Alabama, Florida | 2,373 | 2,265 | 2,139 |
| New Mexico | 8,046 | 8,088 | 7,754 |
| Texas | 115,187 | 114,103 | 115,349 |
| East Texas | 9,579 | 9,532 | 7,519 |
| West Texas | 55,063 | 54,089 | 55,192 |
| Texas Gulf | 18,692 | 18,691 | 22,134 |
| Other Texas | 31,853 | 31,791 | 30,504 |
| Wyoming | 16,523 | 16,036 | 14,617 |
| Other Rocky Mountain | 9,176 | 9,214 | 8,080 |
| California | 32,235 | 32,214 | 39,594 |
| Foreign | †14,845 | 16,353 | 16,593 |
| Total | **262,520** | 262,280 | 268,794 |

*Bureau of Mines. †Includes 3,441,000 bbl. in California.

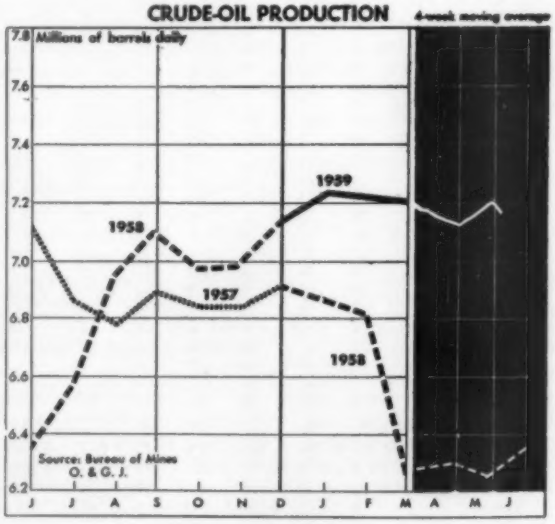
### DAILY AVERAGE PRODUCTION FOR WEEK

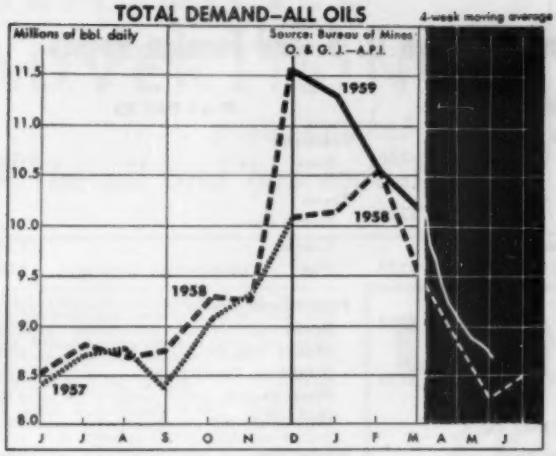
| | June 6, 1959 Crude oil | Lease condensate | Total | May 30 total |
|---|---|---|---|---|
| Alabama | 16,150 | ..... | 16,150 | 16,100 |
| Arkansas | 80,625 | 175 | 80,800 | 80,750 |
| California | 842,500 | ..... | 842,500 | 839,000 |
| Colorado | 128,000 | ..... | 128,000 | 127,800 |
| Eastern | 43,600 | ..... | 43,600 | 41,000 |
| Florida | 1,175 | ..... | 1,175 | 1,150 |
| Illinois | 211,900 | ..... | 211,900 | 210,500 |
| Indiana | 31,500 | ..... | 31,500 | 31,300 |
| Kansas | †320,815 | ..... | †320,815 | †309,950 |
| Kentucky | 65,500 | ..... | 65,500 | 66,700 |
| Louisiana | 868,475 | 105,100 | 973,575 | 972,825 |
| North | 111,700 | 5,100 | 116,800 | 116,825 |
| South | 756,775 | 100,000 | 856,775 | 856,000 |
| Michigan | 26,800 | ..... | 26,800 | 26,800 |
| Mississippi | 124,925 | 4,575 | 129,500 | 126,425 |
| Montana | 79,500 | ..... | 79,500 | 80,100 |
| Nebraska | 61,000 | ..... | 61,000 | 61,200 |
| Nevada | 100 | ..... | 100 | 100 |
| New Mexico | 290,000 | 4,300 | 294,300 | 297,700 |
| North Dakota | 30,100 | ..... | 30,100 | 32,000 |
| Oklahoma | †542,700 | ..... | †542,700 | †556,100 |
| Texas | 2,636,725 | 71,625 | 2,708,350 | 2,861,275 |
| Dist. 1 | 43,650 | 2,900 | 46,550 | 47,000 |
| Dist. 2 | 113,075 | 7,700 | 120,775 | 129,500 |
| Dist. 3 | 357,150 | 35,000 | 392,150 | 404,000 |
| Dist. 4 | 182,575 | 8,800 | 191,375 | 202,600 |
| Dist. 5 | 29,850 | 350 | 30,200 | 32,300 |
| Dist. 6 | 111,850 | 6,500 | 118,350 | 125,500 |
| East Texas field | 146,425 | ..... | 146,425 | 160,000 |
| Dist. 7-B | 134,275 | 100 | 134,375 | 140,100 |
| Dist. 7-C | 126,000 | 3,625 | 129,625 | 139,625 |
| Dist. 8 | 1,080,000 | 4,000 | 1,084,000 | 1,164,000 |
| Dist. 9 | 205,575 | 1,800 | 207,375 | 208,800 |
| Dist. 10 | 106,300 | 850 | 107,150 | 107,850 |
| Utah | 114,500 | ..... | 114,500 | 110,800 |
| Wyoming | 340,000 | ..... | 340,000 | 330,000 |
| Others | ‡175 | ..... | ‡175 | ‡135 |
| Total U. S. | 6,856,765 | 185,775 | **7,042,540** | 7,179,710 |
| Change from prev. week, down | | | **137,170** | ..... |
| Canada | †419,900 | ..... | †419,900 | †450,000 |

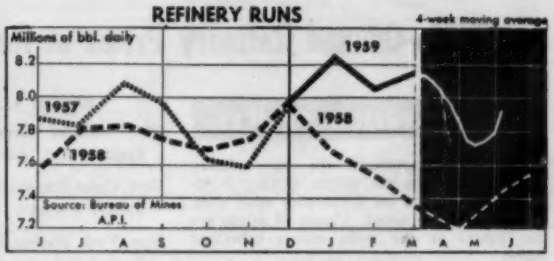
Total U. S. prod., Jan. 1-June 6 ..... 1,127,997,200 bbl.
Same period last year (crude plus cond.) ..... *1,017,403,600 bbl.

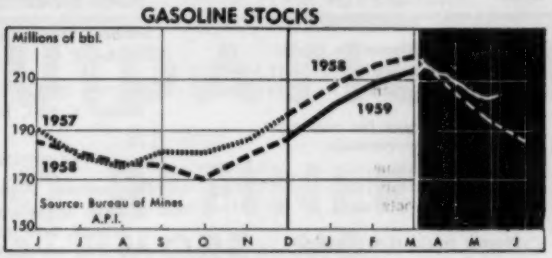
*Includes 25,718,950 bbl. condensate. †Week ended previous Monday. ‡Arizona, South Dakota, and Washington.

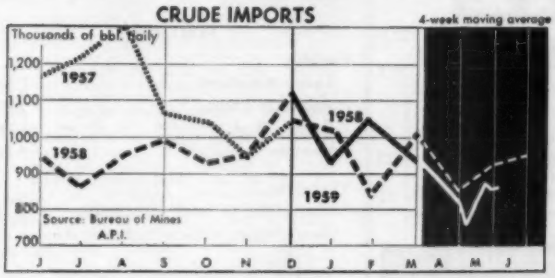
### CRUDE-OIL PRODUCTION

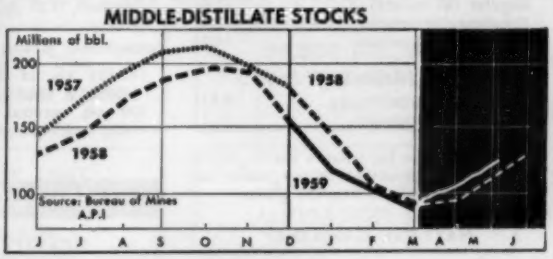


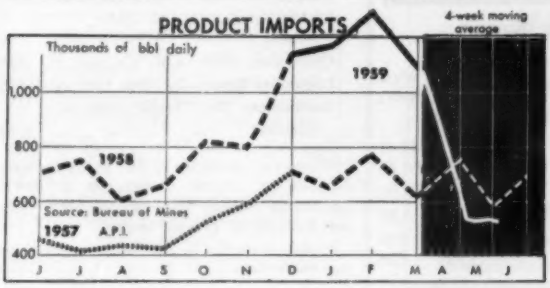


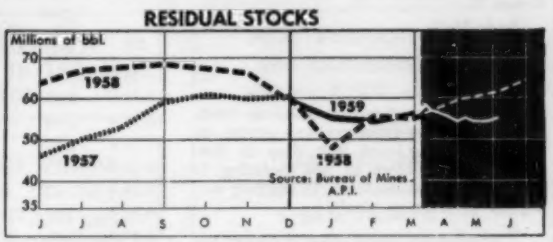




## API REFINERY REPORT—JUNE 5, 1959

(Thousands of barrels)

| District— | Daily avg. runs | Daily average production— Gaso.* | Kero. | Dist. | Resid. | Stocks‡ Gaso.† | Kero. | Dist. | Resid. | Bureau of Mines, June, 1958 Daily avg. runs | Daily average production— Gaso.* | Kero. | Dist. | Resid. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East Coast | 1,044 | 497.0 | 15.4 | 311.1 | 166.1 | 47,408 | 9,563 | 36,262 | 13,173 | 1,093 | 497.9 | 20.1 | 285.4 | 171.9 |
| Appalachian: | | | | | | | | | | | | | | |
| Dist. 1 | 98 | 41.9 | 3.3 | 21.4 | 13.9 | 5,247 | 568 | 2,126 | 325 | 94 | 42.2 | 2.5 | 21.6 | 5.8 |
| Dist. 2 | 100 | 54.4 | 4.1 | 19.6 | 10.4 | 2,722 | 441 | 953 | 225 | 108 | 55.4 | 5.7 | 17.3 | 7.3 |
| Ind., Ill., Ky. | 1,507 | 751.0 | 63.6 | 265.6 | 187.1 | 36,358 | 4,797 | 15,475 | 4,044 | 1,373 | 718.9 | 60.3 | 265.0 | 124.5 |
| Minn., Wis., Dak. | 111 | 58.1 | 6.2 | 26.0 | 14.3 | 6,861 | 700 | 3,754 | 393 | 109 | 53 | 5.7 | 28.4 | 10.0 |
| Okla., Kans., Mo. | 763 | 432.6 | 9.4 | 193.3 | 25.9 | 19,486 | 1,038 | 7,255 | 733 | 742 | 416.4 | 12.5 | 174.9 | 25.5 |
| Inland Texas | 297 | 204.9 | 10.3 | 47.3 | 25.3 | 7,146 | 301 | 1,427 | 2,078 | 272 | 192.9 | 5.3 | 45.3 | 18.2 |
| Texas Gulf Coast | 2,012 | 1,012.4 | 104.3 | 510.9 | 175.7 | 26,606 | 3,622 | 12,775 | 5,231 | 1,633 | 839.3 | 68.4 | 382.6 | 178.6 |
| La. Gulf Coast | 755 | 379.7 | 48.3 | 166.3 | 55.9 | 11,370 | 2,695 | 5,674 | 1,596 | 613 | 362 | 38.2 | 149.2 | 45.0 |
| N. La. and Ark. | 85 | 33.4 | 3.4 | 20.1 | 5.1 | 4,282 | 617 | 2,041 | 151 | 100 | 41.7 | 4.3 | 25.5 | 6.6 |
| Rocky Mountain: | | | | | | | | | | | | | | |
| New Mexico | 25 | 12.3 | 0.3 | 5.1 | 3.3 | 763 | 42 | 127 | 123 | 27 | 13.5 | 0.5 | 5.1 | 2.5 |
| Other Rocky Mt. | 303 | 137.1 | 5.1 | 57.0 | 40.1 | 6,167 | 236 | 2,197 | 1,128 | 294 | 134.6 | 3.5 | 61.1 | 30.7 |
| West Coast | 1,180 | 587.3 | 5.7 | 191.6 | 297.0 | 29,189 | 443 | 12,430 | 26,415 | 1,069 | 485.6 | 5.6 | 150.0 | 284.8 |
| June 5, 1959 | 8,280 | 4,202.1 | 279.4 | 1,835.3 | 1,020.1 | 203,605 | 25,063 | 102,496 | 55,615 | 7,527 | 3,853.4 | 232.6 | 1,611.4 | 911.4 |
| May 29, 1959 | 7,888 | 4,071.6 | 242.9 | 1,767.4 | 951.9 | 203,140 | 24,030 | 97,544 | 54,669 | ..... | ..... | ..... | ..... | ..... |
| June 6, 1958 | 7,690 | 3,880.7 | 246.4 | 1,750.1 | 967.9 | 193,025 | 22,344 | 93,037 | 62,810 | ..... | ..... | ..... | ..... | ..... |

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

# Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

## REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

### GASOLINE*

**Mid-Continent (Group 3):**

| | |
|---|---|
| Regular (89 octane) | 11.375-11.75 |
| Premium (99 octane) | 14.375-14.75 |

**Gulf Coast (cargoes for coastwise or export movements):**

| | |
|---|---|
| ★ Regular (90 octane) | 9.75-10.00 |
| ★ Regular (92 octane) | 10.00-10.25 |
| ★ Premium (98 octane) | 11.125-11.375 |

**California (rack) (Los Angeles):**

| | |
|---|---|
| Regular (88 octane) | 12.00 |
| Premium (94 octane) | 13.00 |
| Premium (100 octane) | 14.50 |

**Caribbean area (cargoes):**

| | |
|---|---|
| ★ Regular (87 octane) | 9.625 |
| ★ Premium (97 octane) | 11.25 |

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

### NATURAL GASOLINE*

**Group 3:**

| | |
|---|---|
| Grade 26-70 | 4.5 |

**Breckenridge:**

| | |
|---|---|
| Grade 26-70 | 4.0 |

*If 26-70 natural is considered as 100%, prices for lower-vapor-pressure grades increase 2.5% for each unit drop in Reid vapor pressure down to and including 16 lb. Prices for grades below 16 lb. may vary slightly by areas or plants.

### KEROSINE AND DISTILLATE

**Mid-Continent (Group 3):**

| | |
|---|---|
| Kerosine 42-44 | 9.75-10.00 |
| Diesel oil (58 d.i. and above) | 9.50-9.75 |
| Distillate No. 1 | 9.50-9.75 |
| Distillate No. 2 | 8.75-9.00 |

**Gulf Coast (cargoes):**

| | |
|---|---|
| Kerosine 41-43 | 8.75 |
| Distillate No. 2 | 8.25 |

**New York Harbor (barges):**

| | |
|---|---|
| ★ Kerosine 41-43 | 9.90 |
| ★ Distillate No. 2 | 9.40 |
| ★ Diesel fuel, 48-52 d.i. | 9.65 |

**Caribbean area (cargoes):**

| | |
|---|---|
| Distillate No. 2 | 8.25-8.625 |

### WAX (LB.)

**Oklahoma (Group 3):**

| | |
|---|---|
| 132-135 A.m.p. (semi-refined) in tank car | 6.50 |

**New York (export):**

| | |
|---|---|
| 126-130 A.m.p. crude-scale (solid in bags or barrels) | 7.35 |

★Denotes change from previous week.

### RESIDUAL FUEL (BBL.)

**Mid-Continent (Group 3):**

| | |
|---|---|
| Residual fuel (max. 1% S) | $1.85-2.00 |

**Gulf Coast (cargoes):**

| | |
|---|---|
| Bunker C fuel | $2.00 |

**New York Harbor (barges):**

| | |
|---|---|
| Bunker C fuel | $2.37 |

**Caribbean (cargoes):**

| | |
|---|---|
| Bunker C | $2.00 |

**California (rack):**

| | |
|---|---|
| Bunker C fuel, Los Angeles | $2.15 |

### LUBRICATING OILS

**Mid-Continent (Group 3):**

| | |
|---|---|
| 150-160 bright stock, solvent refined, 0-10 pp., 95 v.i. | 23.0 |
| 200 vis. neutral oil, solvent refined, 0-10 pp., 95 v.i. | 20.5 |

**Pennsylvania Grade:**

| | |
|---|---|
| 145-155 vis. at 210, bright stock, 8 color, 25 p.t. | 22 |
| 200 vis. neutral (180° at 100°), 25 p.t. | 21 |

## CRUDE-OIL PRICES

### GRAVITY SCHEDULE

| | Signal Hill, Calif. | Oklahoma | Gulf Coast Tex.* | West Tex.† N.M. | Wyo. (sour) |
|---|---|---|---|---|---|
| 14-14.9 | $1.86 | .... | .... | .... | .... |
| 15-15.9 | 1.95 | .... | .... | .... | $1.81 |
| 16-16.9 | 2.04 | .... | .... | .... | 1.86 |
| 17-17.9 | 2.13 | .... | .... | .... | 1.91 |
| 18-18.9 | 2.23 | .... | .... | .... | 1.96 |
| 19-19.9 | 2.32 | .... | .... | .... | 2.01 |
| 20-20.9 | 2.41 | $2.49 | .... | $2.35 | 2.06 |
| 21-21.9 | 2.50 | 2.52 | .... | 2.38 | 2.11 |
| 22-22.9 | 2.60 | 2.55 | .... | 2.41 | 2.16 |
| 23-23.9 | 2.69 | 2.58 | $3.44 | 2.44 | 2.21 |
| 24-24.9 | 2.78 | 2.61 | 3.46 | 2.47 | 2.26 |
| 25-25.9 | 2.84 | 2.64 | 3.48 | 2.50 | 2.31 |
| 26-26.9 | 2.90 | 2.67 | 3.50 | 2.53 | 2.36 |
| 27-27.9 | 2.95 | 2.70 | 3.52 | 2.56 | 2.49 |
| 28-28.9 | 3.01 | 2.73 | 3.54 | 2.59 | 2.54 |
| 29-29.9 | 3.07 | 2.76 | 3.56 | 2.62 | 2.59 |
| 30-30.9 | 3.12 | 2.79 | .... | 2.65 | 2.63 |
| 31-31.9 | 3.20 | 2.82 | .... | 2.68 | 2.67 |
| 32-32.9 | 3.27 | 2.85 | .... | 2.71 | 2.71 |
| 33-33.9 | 3.34 | 2.88 | .... | 2.74 | 2.75 |
| 34-34.9 | 3.41 | 2.91 | .... | 2.77 | 2.79 |
| 35-35.9 | 3.47 | 2.94 | .... | 2.80 | 2.83 |
| 36-36.9 | 3.52 | 2.97 | .... | 2.83 | 2.87 |
| 37-37.9 | 3.56 | 2.99 | .... | 2.86 | 2.89 |
| 38-38.9 | .... | 3.01 | .... | 2.89 | 2.91 |
| 39-39.9 | .... | 3.03 | .... | 2.92 | 2.93 |
| 40-40.9 | .... | 3.05 | .... | 2.95 | 2.95 |

*Low cold test crude. †Sour.

Effective dates of broad changes: California, 1-26-59; East of California, January 3-10, 1957; Pennsylvania Grade 4-1-59.

### FLAT PRICES

**Louisiana:**

| | |
|---|---|
| Sweet Lake | $3.00 |

**Texas:**

| | |
|---|---|
| East Texas | 3.25 |
| Conroe | 3.53 |
| Van | 3.08 |

**Pennsylvania Grade:**

| | |
|---|---|
| Bradford | 4.25 |
| Middle District | 4.07 |
| Southwest Pennsylvania | 3.80 |
| West Virginia | 3.67 |
| Buckeye Grade | 3.47 |

| | |
|---|---|
| **Illinois Basin** | **3.00** |

### FOREIGN

**Canada:**

| | |
|---|---|
| Leduc-Woodbend | 2.53 |
| Redwater (Alta.) | 2.42 |
| Smiley (Sask.) | 2.18 |
| Pembina | 2.38 |

**Venezuela:**

| | |
|---|---|
| Cumarebo, 48°-49.9°, Tucupido | 3.34 |
| San Joaquin, 41°-41-9°, Puerto La Cruz | 3.08-3-10 |
| Oficina, 35°-35.9°, Puerto La Cruz | 2.80 |
| Tia Juana medium, 26°-26.9°, Amuay* | 2.30 |
| Quiriquire, 16.0°-16.4°, Caripito | 2.10 |
| Lagunillas heavy, flat, Las Piedras* | 2.10 |
| Bachaquero, flat, 15°-16°, Las Piedras* | 1.88 |

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° very 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

**Middle East, Persian Gulf (cargoes f.o.b. lifting port):**

| | |
|---|---|
| Arabian, about 34°, Ras Tanura | $1.89 |
| Iranian, 34.0°-34.9°, Bandar Masur | 1.86 |
| Iranian, 34.0°-34.9°, Abadan | 1.81 |
| Iraq, 36.0°-36.9°, Fao | 1.82 |
| Kuwait, 31.0°-31.9°, Mina-al-Ahmadi | 1.67 |
| Qatar, about 41°, Um Said | 2.05 |

**Middle East, E. Mediterranean:**

| | |
|---|---|
| Arabian, about 35°, Sidon | 2.29 |
| Iraq, about 35°, Tripoli, Banias | 2.29 |

**Far East (cargoes, f.o.b. Lutong, Sarawak):**

| | |
|---|---|
| Seria Light, 37° | 2.57 |

### TANKER RATES PER LONG TON

(Latest reported spot fixtures)

| | |
|---|---|
| ★ Gulf-USNH, clean (ATRS—35%) | $1.85 |
| Gulf-USNH, dirty (ATRS—35%) | 1.85 |
| ★ Carib.-USNH, clean (ATRS —47.5%) | 1.44 |
| ★ PG-USNH, dirty (USMC—75%) | 3.18 |

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1—150 TON B.J. HOOK
1—IDECO 5 SHEAVE CROWN BLOCK GROOVED FOR 1¼" LINE
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NATIONAL 50 located in Park County, Wyo.

NATIONAL 75 located in Lincoln County, Wyo.

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# ESSO REFINERY
## BALTIMORE, MD.

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|---|---|
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1—Carrier 9,370 cfm. centrifugal compressor, 124.7 psi, 2,310 hp. Turbine.

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1—Lummus Horizontal Tube Furnace. 1,308 sq. ft.

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HELP WANTED

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**THE OIL AND GAS JOURNAL,**
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PRODUCTION ENGINEER: Growing independent oil company has opening for graduate petroleum engineer with minimum of 4 to 6 years completion and production experience, preferably in Gulf-Coast, Mid-Continent areas. Work will be in north and west Texas, central Oklahoma, and north and south Louisiana. Age: 25 to 35. Salary commensurate with experience. Submit complete resume of experience and education to: Box L-386, The Oil and Gas Journal, Tulsa, Oklahoma.

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Graduate mechanical or petroleum engineer with four years experience in water flood or secondary recovery projects. Large company. Excellent employee benefits. Age 28-45. Submit resume to:
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**THE OIL AND GAS JOURNAL,**
**TULSA OKLAHOMA.**

## WATERFLOOD EQUIPMENT ENGINEER

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**BOX L-384,**
**THE OIL AND GAS JOURNAL,**
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**Box L-309,**
**The Oil and Gas Journal,**
**Tulsa, Oklahoma.**

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*Inquiries will be treated in confidence.*

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**Products Terminals and Pipelines**

WANTED: Experienced engineer capable of establishing and supervising engineering department for construction of petroleum products terminals and products pipelines, including complete design, issuance of quotation requests and material authorizations, supervision of construction engineers and approval of subcontractors' designs. Must be able to provide preliminary design rapidly and estimate construction costs accurately enough to provide basis for competitive bids. Must have field experience in design and construction of terminals and pipeline including hydraulic, electrical, civil and mechanical design, and have mental capability of working for non-engineer. Will be located in Southwest. Some travel required. Will guarantee three years employment $20,000 year, if ability proven by performance. Send resume including references to: **Box L-352, The Oil and Gas Journal, Tulsa, Okla.**

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REFINERY MAINTENANCE ENGINEER, with at least two to three years experience willing to develop into maintenance supervisor for modern refinery in mid-continent area. Our employees have been informed of this advertisement. Box L-377, The Oil and Gas Journal, Tulsa, Oklahoma.

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## SITUATION WANTED

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## SITUATION WANTED

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FLUENT SPANISH translator, interpreter and bi-lingual secretary. (Valladolid, Spain, University diploma) English born woman with many years excellent business experience London and Madrid. Seeks responsible and interesting position preferably Venezuela or other Latin country. K. Chuck, Apartado 14.037, Madrid, Spain.

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**Edificio Galipan Caracas, Venezuela**
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# ADVERTISERS in this issue


A

ACF Industries, Incorporated W-K-M Division . . . 109
Allis-Chalmers . . 44, 45, 123, 125, 127, 129
American Air Filter Co., Inc. . . . 18
American Meter Company . . . 130

B

Baker Oil Tools, Inc. . . . 58
Barclay Hotel, The . . . 142
Bethlehem Steel Company Supply Division . . . 120
Black, Sivalls & Bryson, Inc. . . . 116
Braniff International Airways . . . 14
British Petroleum Company Limited, The . . . 51
Butler Manufacturing Company . . . 139

C

Cameron Iron Works, Inc. . . . 151
Campbell Chain Company . . . 47
Clark Bros. Co. One of the Dresser Industries . . . 83
Classified Advertising . . . 171, 172, 173, 174
Collins Radio Company . . . 105
Colorado Fuel and Iron Corp., Wickwire Spencer Steel Division . . . 31
Continental-Emsco Company, a Division of The Youngstown Sheet and Tube Company . . . 21, 22, 23, 24
Continental Equipment Co. . . . 54
Coppus Engineering Corp. . . . 41
Core Laboratories, Inc. . . . 152
Corrosion Services Incorporated . . . 134
Crose Manufacturing Co., Inc., M. J. 128
Cummins Sales & Service, Inc. . . . 150

D

DeZurik Corporation . . . 133
Dorr-Oliver Incorporated . . . 77
Dow Chemical Company, The . . . 27
Dowell . . . 1, Inside Back Cover

E

Edward Valves, Inc. . . . 150

F

Fairbanks, Morse & Co. . . . 117
First City National Bank of Houston . . 30
First National Bank of Shreveport, The 136
First National Bank & Trust Co. of Tulsa, The . . . 146
Fisher Governor Company . . . 54

G

Gaso Pump & Burner Mfg. Co. . . . 12
Geolograph Company, Inc., The . . . 54
Gorman-Rupp Company, The . . . 138
Grinnell Company, Inc. . . . 5
Gulberson Corporation . . . 32
Gustin-Bacon Manufacturing Co. . . . 110

H

Halliburton Oil Well Cementing Co. 8, 9, 75
Harbison-Fischer Mfg. Co. . . . 49
Hoil Company, The . . . 55
Horton Equipment Co. . . . 128
Hughes Tool Co. . . . Back Cover

I

International Paints (Export) Ltd. . . . 133

J

Jones & Laughlin Supply Division . . 10, 11

K

Kellogg Switchboard Supply Company Communications Division of International Telephone and Telegraph Corporation . . . 7
Kennametal, Inc. . . . 161
KLM Royal Dutch Airlines . . . 135

L

Layne & Bowler Company, The . . . 13
Lone Star Steel Company . . . 112, 113
Love Box Company, Inc., The . . . 55
Lufkin Foundry & Machine Co. . . . 111
Lunkenheimer Co., The . . . 25

M

Macco Oil Tool Co. . . . 133
Mack Trucks, Inc. . . . 19
Magnet Cove Barium Corp. . . . 16, 17
Marbon Chemical Division of Borg-Warner . . . 20
Mid-Continent Supply Company . . . Inside Front Cover
Milwhite Mud Sales Company . . . 147
Mission Mfg. Company . . . 52
Mixing Equipment Co., Inc. . . . 35

N

National Airoil Burner Co., The . . . 50
National Tank Company . . . 176
Nordstrom Valve Division, Rockwell Manufacturing Company . . . 137
Norris Manufacturer, Inc., W. C. . . . 4

O

Orbit Valve Company . . . 46
Otis Engineering Corporation . . . 141

P

Paris Distributor, Inc., Henry H. . . . 130
Parkersburg Rig & Reel Co. . . . 40
Peerless Pump Division of Food Machinery & Chemical Corporation . . . 26
Penn Controls, Inc. . . . 147
Porter Company, Inc., H. K.—Thermoid Division . . . 142
Price Company, H. C. . . . 60

R

Republic National Bank of Dallas . . . 54
Republic Rubber Division of Lee Rubber & Tire Corp. . . . 43
Reynolds Metals Company . . . 36, 37
Robbins & Myers, Inc. . . . 132
Rockwell Manufacturing Company, Instruments Division . . . 28, 29
Rockwood Sprinkler Company . . . 34
Ross-Martin Co. . . . 149

S

SKF Industries, Inc. . . . 38, 39
Smith Oil Tool Co., H. C. . . . 148
Southern California Oil Tool Company 149
Southwestern Graphite Co. . . . 151
Stran-Steel Corporation . . . 53
Sumitomo Metal Industries, Ltd. . . . 135
System Analyzer Corp. . . . 126

T

Thermoid Division, H. K. Porter Company, Inc. . . . 142
Thomas Flexible Coupling Co. . . . 140
Tretolite Company A Division of Petrolite Corporation . . . 33

U

United States Rubber Company . . . 144
United States Steel Corporation—Witte Engine Works Oil Well Supply Division . . . 6

V

Vinson Supply Company . . . 107
Vogt Machine Co., Henry . . . 48

W

Walker Co., W. L. . . . 126
Waukesha Motor Company . . . 42
Welex, Inc. . . . 56
Well Equipment Mfg. Corp. . . . 115
Wheland Company, The . . . 15
Wickwire Spencer Steel Division, Colorado Fuel and Iron Corp. . . . 31
Williams Brothers . . . 145
Witte Engine Works Oil Well Supply Division, United States Steel Corporation . . . 6
W-K-M Division of ACF Industries Incorporated . . . 109

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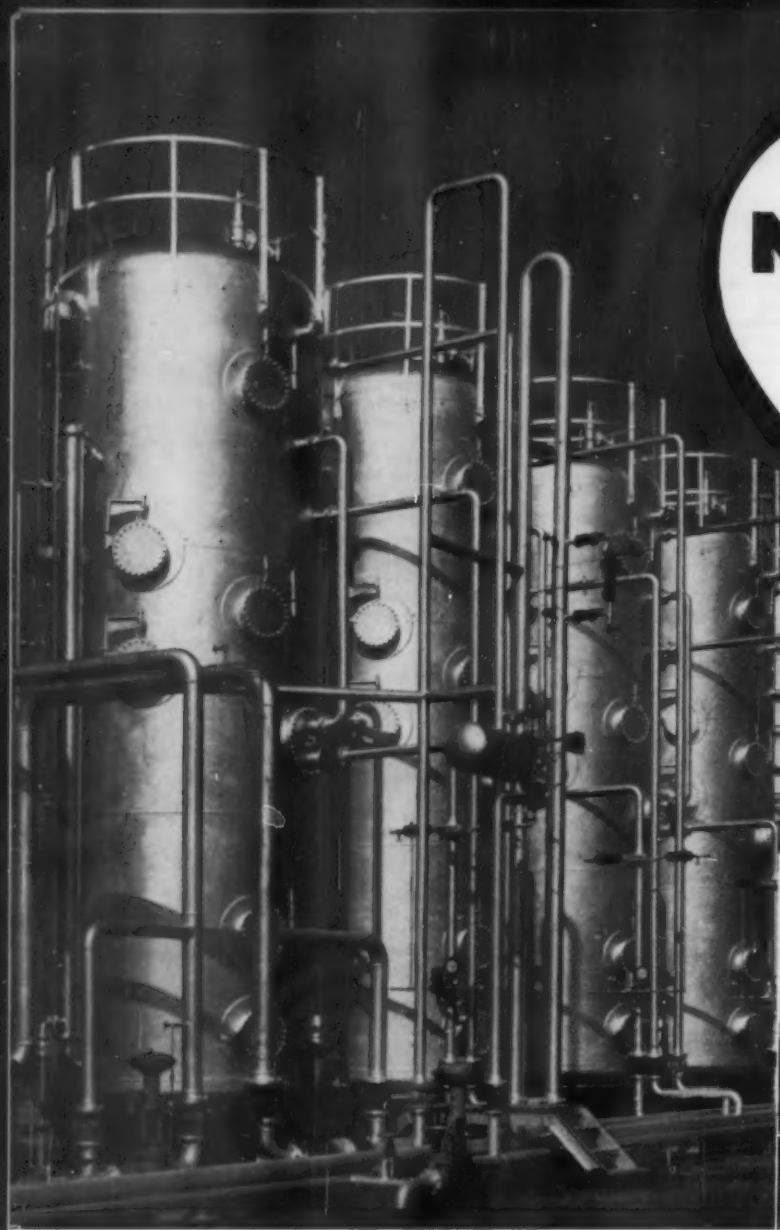

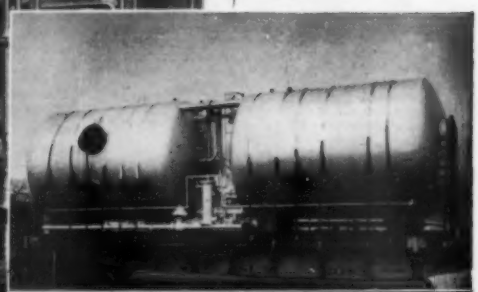

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